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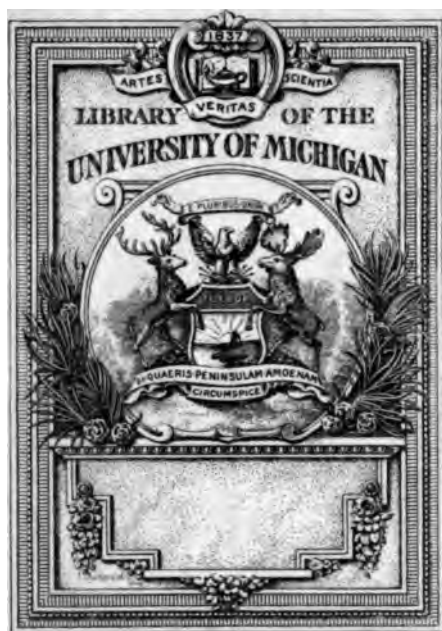
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SMITHSONIAN
MISCELLANEOUS COLLECTIONS.

VOL. XIV.



"EVERY MAN IS A VALUABLE MEMBER OF SOCIETY WHO BY HIS OBSERVATIONS, RESEARCHES,
AND EXPERIMENTS PROCURES KNOWLEDGE FOR MEN."—SMITHSON.

WASHINGTON:
PUBLISHED BY THE SMITHSONIAN INSTITUTION.
1878.

PHILADELPHIA:
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JOSEPH HENRY,
Secretary S. I.

(vii)

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

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SYNOPSIS
OF
AMERICAN WASPS.

BY
DR. HENRI DE SAUSSURE,
OF GENEVA, SWITZERLAND.

SOLITARY WASPS.



WASHINGTON:
SMITHSONIAN INSTITUTION.
DECEMBER, 1875.

ADVERTISEMENT.

THE present publication is the first part of a Synopsis of American Vespidae or Wasps, prepared by Dr. Henri De Saussure of Geneva, Switzerland, one of the highest living authorities on the subject.

This work relates to the "Solitary Wasps," and has been the result of many years of careful study and patient investigation. Unforeseen events have occurred to delay its publication, in addition to the loss of time occasioned by the necessity of transmitting the proofs and revises to the author in Europe.

In the introduction will be found suggestions by the distinguished author as to the philosophy of points of natural history, well worthy the attention of the general students of this branch of science, and the whole work will doubtless be considered a valuable addition to the sources of knowledge on entomology.

The Institution acknowledges the important aid rendered in the translation of the work into English, its careful preparation for the press and the revision of the proof-sheets, by Mr. Edward Norton of Farmington, Conn., whose services have also been acknowledged in the annexed dedication by the author.

JOSEPH HENRY,
Secretary S. I.

SMITHSONIAN INSTITUTION,
WASHINGTON, December, 1875.

PHILADELPHIA
COLLINS, PRINTER.

DEDICATION.

TO MR. EDWARD NORTON.

Sir:—

I am desirous of dedicating to you this first attempt to draw up a Hymenopterological Fauna of North America. The unflagging interest you have kindly taken in this work emboldens me to hope that you will accept my offering.

The readiness with which you placed at my service your collections, and the assistance of your valuable instructions, were already sufficient claims to my gratitude. Your kindness in taking upon yourself the task of translator makes me feel more strongly the extent of my obligations to you.

It is for me a subject of regret that my imperfect acquaintance with the English language has not permitted me to relieve you from the trouble of this work. Had I been capable of composing this book in the idiom in which it is to appear before the public, the many hours of enjoyment I have had in writing it would not be contrasted with the many tedious hours it is likely to occasion you.

Beside the peculiar charm which the study of nature ever possesses, the drawing up of this monograph has wafted me in thought to those regions of the New World which have, since I was a child, allured me with an irresistible spell. While conning over my insects, many a remembrance has loomed before my mind, and transported me to those thought-inspiring and soul-stirring scenes of your magnificent country. As a Swiss, I felt

a secret pride in reflecting that its institutions are analogous to those of my own dear country, and that the grandeur of its physical scenery and the intellectual life which animates all classes of its people, have their counterpart in Helvetia.

For me it is a source of satisfaction to be able to contribute, in my humble sphere, to the extension of the physical knowledge of that part of the American continent, whose natural riches we are daily more and more able to appreciate, thanks to the untiring zeal of its scientific men.

I trust, sir, you will deign to read these lines with an indulgence equal to the sincerity with which they are addressed to you, and that you will see in them a pledge of my gratitude and devotedness.

HENRI DE SAUSSURE.

GENEVA, SWITZERLAND, 1 May, 1863.

PREFACE.

I PUBLISHED in 1852 my *Monograph on the Solitary Wasps*;¹ which forms the first volume of my *Studies on the Family of the Vespidae*.² As soon as that work was printed, I perceived that it was very imperfect.

I was still a mere student when I composed the greater part of this book; it bears too evident marks of its premature publication. I consequently felt the necessity of correcting and completing it by means of a Supplement which occupies the greater part of the third volume of the *Studies on the Family of the Vespidae*. This, however, was insufficient.

To the imperfections in the MS. of the work, attributable to my inexperience, were added those of the form. I had the misfortune to fall into the hands of a printer who not only delayed for years the publication of the work, but who also executed it in a shameful manner, neglecting to make proof corrections, and printing the notes in the midst of the text.

Having lost all patience with the delay and errors of the work, I turned my back on the social wasps and started for America, leaving to the care of my excellent and worthy friend, Dr. Siebel, who had often aided me with his skill and advice, the task of superintending the impression. Two years after, on my return to Europe, I found that only three or four sheets had been printed, and that the third volume was only on the eve of being finished, and it was not until 1857 and 1858 that the volume on the social wasps was completed, by the appearance of the general part, in which were developed the facts concerning the nidification of these insects, of which a summary alone had appeared in 1853 and 1854, in the explanation of the plates, and in a special paper. But

¹ *Monographie des Guêpes Solitaires*. Genève, Paris.

² *Etudes sur la Famille des Vespides*, 3 vols. and atlas.

during the three years, while the manuscript had lingered in the hands of the printer, there had appeared a memoir, by Dr. Möbius, on Wasps' Nests, so that my work, at the time of its publication, was in arrear of science.¹

To these contingencies I must add the death of the artist M. Vaillant,² of so interesting memory, during the publication of the first volume. The succeeding draughtsmen, by whom I replaced him, were far from equalling him, and have often produced inferior, sometimes even bad drawings.³

It will be easily understood that all these vicissitudes have not a little contributed to render the work defective. From the very first, I have felt the necessity of recasting it. But as I could not undertake fresh journeys to visit the collections in distant centres, Paris, London, etc., I have adopted another method, which consists in correcting and completing my studies on the Family of the Vespidae by means of successive memoirs, resulting from the study of collections, which are kindly communicated to me.⁴ All these works, together, will perhaps enable me one day to recompose a general work. An excellent oppor-

¹ When, at length, the work was completed by the tardy appearance of the general part of the 2d volume, Mr. Gerstaecker spoke of this general part in his annual report on the progress of Entomology (Troschel's Archives), calling it, I know not for what reason, the commencement of a fourth volume. He reproached it disparagingly for not noticing recent works. True it is, he could not guess that it was an old laggard which had been some years in press.

² Mr. Vaillant was the artist attached to the scientific exploration of Algeria.

³ The drawings of the Pl. XVI, of Tome I, are in particular very bad.

⁴ I have thus composed the following memoirs, forming, as it were, a supplement to my *Studies on the Vespidae*:—

1. *Description de quelques nouvelles Espèces de Vespides du Musée de Londres.* (Revue de Zoologie, VII, 1855.)

2. *Nouveaux Vespides du Mexique et de l'Amérique septentrionale.* (Revue de Zoologie, IX, 1857.)

3. *Note sur la Famille des Vespides.* (Ibid., X, 1858.)

4. *Note sur les Polistes Américains.* (Ann. Soc. Ent. de France, 1857.)

5. *Description de quelques Vespides nouveaux.* (Ibid., 1857.)

6. *Bemerkungen über die gattung Vespa.* (Entomol. Zeitung von Stettin, 1857.)

7. *Sur divers Vespides Asiatiques et Africains du Musée de Leyden.* (Ibid., 1862.)

tunity of extending my studies on the Wasps offered itself when the Smithsonian Institution was pleased to commission me to establish the fauna of the Hymenoptera of North America. I was already in possession of numerous materials for the drawing up of such a work. I had brought from that continent considerable collections, the fruits of my explorations in West India, Mexico, and the United States. I had likewise acquired collections of Hymenoptera in my passage through this latter country, of Mr. Rathvon (Lancaster, Pa.), Mr. Fuch (Tennessee), and others. Prof. Haldemann kindly made me a present of the remnants of his splendid collection, unfortunately almost destroyed. To these materials which I had got together as I went along, there came to be added later, the collections which the Smithsonian Institution forwarded me from different regions of the United States.¹ But I owe a special mention to my friend Mr. Edw. Norton, of Farmington, Connecticut, an excellent entomologist, who afforded me the most valuable assistance for the work to which these lines serve as an introduction, and who with extreme kindness offered to undertake the translation of this volume himself. Finally, I have, moreover, received some parcels of insects direct from divers friends, especially from Tennessee, from Engineer de Freudenreich Falconnet, Engineer on the Nashville Railroad, and since then Major in the Confederate Army; from California, through Mr. Berton, Swiss trader at St. Francisco, and by Mr. Sutter.

Notwithstanding all these contributions, the collections which I myself brought from America still form the staple of my materials; but these subsequent additions are very useful complements. I, therefore, avail myself of this opportunity to thank publicly

¹ Hymenoptera from Rock Island, South Illinois, collected by Kennicott.

“ “ from Illinois, collected by Walsh.

“ “ from Lake Superior, collected by L. Agassiz.

“ “ from Williamstown, Massachusetts, collected by S. H. Scudder.

“ “ of the Cape St. Lucas, California, collected by John Xantus.

“ “ from Rio Peros River, collected by Capt. Pope, U. S. A., and various other Hymenoptera collected at Fort Tejon, California; English River, etc.

The first five collections had been formed by individuals in the interest of science; the others by explorations carried on by order of government.

all the above-mentioned persons for the assistance which they have kindly afforded me. Among them I ought to name especially, Prof. Henry, as director of the Smithsonian Institution, and Prof. Baird, who have always shown me the greatest kindness.

I ought, however, to inform the reader that, notwithstanding so much help, the work does not contain all the species of America. I myself possess divers individuals, which, without offering characteristics distinct enough to be described from one individual, nevertheless betray the existence of species yet unknown. Moreover, the larger part of the smaller species seem till now to have baffled the researches of collectors. I do not hesitate to affirm, that, had I been able to collect undisturbedly in the United States, I should very likely have brought back from that country a number of small species as considerable as that which I have brought from Mexico.

But it is in the natural progress of science to advance gradually towards completeness; and consequently, it is the lot of books of science to grow old and become obsolete; and thus, in their turn, to give way to more complete works. I do not, therefore, consider this monograph, incomplete as it may be, without its use. I am not one of those who suppose it possible to exhaust a subject of investigation. On the contrary, I am of opinion that in entomology, as well as in the other branches of science, nothing perfect, nothing absolutely complete, can be accomplished, seeing that everything in nature is undefined. The naturalists who think the contrary, and who are induced constantly to put off the publication of their labors from believing they shall wholly complete them, succeed but too often in losing the fruits of their studies; either because their writings grow old while lying by, or because the authors are overtaken by death. The proper method in the study of nature is not that of perfection, but, on the contrary, that of approximation. Because from approximation to approximation, we are always getting nearer exactness and completeness, without ever attaining extreme perfection. In that precisely consists the progress of science, and that also it is which gives to its horizon the depth of infinitude.

The foregoing was written some years ago. In 1865 the manuscript of the memoir was sent to the Smithsonian Institution.

Its publication was at first delayed by the pressure of other matter, then by an unfortunate fire which embarrassed the finances of the Institution, and lastly the slow delays below mentioned.

The book has been in the press several years, in consequence of the great loss of time caused by the transmission of the proofs from Europe to America, and *vice versa*.

In consequence of this long period of waiting, I have been obliged to make a review of the manuscript in reference to the writings of various entomologists, especially those of Mr. Cresson, which have been published from year to year, and have changed the names of the species which I had described and have adopted the names given by this author. I have not been able, however, to take account of the more recent writings of Mr. Cresson, on the Hymenoptera of Texas, which only came to my knowledge when the printing of this book was almost finished.

The reader will excuse certain irregularities, consequent upon the difficulty of putting a work into perfect symmetry which was to be printed on the other side of the Atlantic. Hence the author has never had but a part of his work before his eyes at a time, during the long course of this publication. For example, it will be noticed in the synonymy that my work, "*Etudes sur la Famille des Vespides*" is sometimes cited "*Et. Vesp.*," sometimes only "*Vespides*." So with the "*Revue et Magazine de Zoologie*," it is sometimes cited "*Rev. et Mag. de Zoolog.*," and sometimes simply "*Rev. de Zool.*"

The larger part of the book was written in French, and has been translated and corrected by Mr. Edward Norton. I owe to this naturalist also various communications and frequent sendings of insects, which have been of great use to me.

H. DE SAUSSURE.

INTRODUCTION.

I PROPOSE in this volume, not to give a general history of the Wasps of America, but only to lay the foundations of the fauna of the Vespidae of that continent, principally of North America. I leave aside whatever concerns the habits of these insects, on which we have but insufficient information, and I shall confine myself to speaking of them with respect to the genera or species which offer salient peculiarities.

This work is not to be taken for a mere catalogue of species, of no further use than to satisfy curiosity. I think that modern zoology ought to tend towards another aim. The existence of species, the composition of fauna, their relations with the parts of the globe which they populate, are not merely accidental facts. In my opinion, we must therein detect the last material and tangible manifestation of physiological forces, elucidating the study of which belongs to the domain of the highest natural philosophy. By him who adopts this view of the subject, a far-searching study of species ought to be considered as one of the bases from which the search after the origin of species may start.

It would seem that in zoology we should take for a starting-point the actually existing forms in which life manifests itself, and to ascend from them up to the primitive stock; just as in geology, we start from the actual existing structure of rocks and from the external configuration of the soil, to follow up the concatenation of the ancient events which have brought about as a last result the present state of the earth's crust.

The study of species ought especially to serve as a means of revealing to us their variations and the affinities between them. These affinities point to a common *relationship*, which is to be explained only by a direct *affiliation* of the types. The study of

forms combined with that of their geographical distribution, comes afterwards to throw light on the cause of the filiation which the graduated resemblances of the species serve to reveal to us. It shows that this filiation obeys laws which have also their regularity, in so far as they are intimately connected with the physical laws which hold sway in every region of our globe.

Toward these grand philosophical queries, zoology ought in our time to tend, and species should be studied with a view to the solution of such questions. As in geology, the study of the actual existing state of the earth's crust, and the appreciation of the phenomena that there take place, of the intimate transformation of rocks, of the mechanical disturbance of the layers, of their reconstruction under new forms, allows us to draw an inference by analogy as to the more ancient transformations, and the agents which have produced them; so the study of species, and of their actual existing transformations seems likely to enable us to follow up the chain of these transformations to a point more or less close to their origin.

The definition of the first divergences observable in the permanent varieties which may be considered as *nascent species*, in order to ascend afterwards to the relationship of species separated by divergences more and more profound, such is, we deem, the point of view under which we should never neglect to study species.

Zoology, only when considered from this point of view is philosophical. It has not its aim in itself; it serves only as a means to sift questions of a higher order. Now entomology is precisely the one of the branches of zoology, in which the study of the filiation of species may become the most fruitful in results, either on account of the multitude of ramifications of general types and of the multiplicity of forms under which each type appears, or on account of the smallness of the breaks which separate genera and species, or also on account of the immense variety of forms and of the facility with which species seem to become modified in proportion as they spread over the surface of the globe in diverging ways. Thanks to all these causes, it is not difficult to find examples of every kind of filiation, not difficult either to follow over latitudes certain still recent modifications which allow us to draw an inference by analogy as to other

modifications more profound because they are more ancient, than as to others of a degree still more advanced.¹

As may be anticipated from what precedes, my principal purpose in producing this work is to study the American fauna with a view to its origin. But this is a work of time which cannot be completed off-hand. The first thing to be done is to study the species carefully, to arrange them according to a good classification, and to describe their affinities. That is the fundamental preparatory labor. I do not pretend to overstep those limits in this monograph. The knowledge of the American fauna is not yet enough advanced to allow us to draw an inference with certainty as to the affinities of the species among themselves so as to prejudge their filiation. However, I have made more than one remark on this topic, and I will hazard a few words on the matter when speaking of genera and species. But I reserve for another work the statement of comparisons which seem to me to cast some light on the dispersion of the Vespidae on the surface of the globe and on the modifications which have been worked off under diverse latitudes; in other terms, on the origin of actual existing fauna.

The complex affinities of species, and still more the filiations which arise from these affinities, become obvious to the eye only when one has acquired a perfect knowledge of the species and genera of a fauna. To seize them in all their extent, it is necessary to know, as it were, all the species of the group by heart in order to be able to take it in at a glance, or to examine at pleasure each part in the picture that one has formed in one's memory. Only when one has attained this point in the study of a group, is it possible, from the inspection of a species, to feel its affinities; for they do not always appear in the more easily

¹ Unfortunately, in our times the greater number of entomologists have deviated too far from this philosophical path. They have turned entomology into a sort of amusement which has for object the discovery of new species; which loses itself in minutiae, and at the bottom of which there exists no thought. Thanks to this tendency, collecting has ceased to be the means, and has become the object. In becoming an amusement entomology has gradually lost caste; it has fallen into the hands of dawdlers, and thus lost a part of its scientific character. This transformation has led men, who aim at reaching an elevated rank in science, to be too much inclined to withdraw from the field of entomology.

appreciable characteristics. They often discover themselves in certain characteristics of appearance, which are at times of great importance, but which are not seized at a glance, or in certain relationships of form, which a long practice teaches one to distinguish easily, though they can scarcely be defined.

The first basis of philosophical zoology is the profound knowledge of the detail of fauna. To give as complete an idea as possible of the fauna of the VESPIDÆ of America is the purpose of this volume.

PLAN OF THE WORK.

The plan which I have decided on, in drawing up this work, is the following:—

I give, as much as possible, a complete description of the species which belong to the fauna of North America, considering as such all those which people the new continent to the north of the isthmus of Panama, including likewise the Antilles. This work is, therefore, more especially a monograph of the Vespidae of the United States, of Mexico, and of the Antilles. Besides, I have added, as a complement, a catalogue of all the species known till now in the rest of America, and have found it a great advantage in the classification, the method thus becoming more complete. Moreover, this plan allows me to enunciate views on the geography of insects, on the dispersion of the species, and on the modifications which take rise under the influence of diverse latitudes.

I have confined myself, among the species of South America, to cataloguing them, not having sufficient materials to make a monograph. However, for those of which I had the types beneath my eyes I have given Latin diagnoses, in order to describe them in a comparative manner with respect to the surrounding species, and, also, in order to complete my anterior studies on these insects, to review them and render the use more easy.

I think myself bound to add here, that, as to my method of description, I describe the species as far as possible in a relative manner. Descriptions made in an absolute sense have always appeared to me less useful, because they insist on many useless characteristics and often omit the most important. The reader

will not be surprised, therefore, at my not repeating, with respect to genera, the characteristics peculiar to every species or to the greatest number of them. In short, there are still other characteristics which I pass over, considering them rather useless either on account of their constancy (such as the presence of silky hairs on the tibiæ) or on account of their variableness, such as the color of the lower surface of the abdomen.

Descriptions are often made prolix by means of these superfluous indications, and thus the essential characteristics are drowned in useless developments. In this way, precision is diminished instead of being increased. Doubtless, here again nothing is absolute. Certain isolated species may be sufficiently characterized by some salient traits, while others surrounded by very closely connected species, require minute descriptions.¹ The first condition of good comparative diagnoses resides in a wise co-ordination of the species which by way of exclusion may lead to choosing only between a small number of species. Though I do not like to find fault, I cannot, however, on this score, help complaining of the works in which the species, though described in an absolute manner (that is, by themselves and not comparatively with others) are jumbled up together without order, without division of genera, often in defiance of the most salient characteristics.

Such works, got up in a hurry, the plans of which are laid down with a view to the convenience of the authors and not for that of the readers, cause the latter to lose much valuable time with no great result. They do not come up to the precision now required by the progress of science, and they are therefore behind their time. The reader cannot occupy his mind with incomplete works, nor can he waste his time in striving to find out species which are not to be found out; for there is no doing impossibilities.

In most of my descriptions, I have been especially attentive to the forms and characteristics of the forms and carving, attributing

¹ Absolute and very detailed descriptions ought, in my opinion, to be employed, when one describes species isolatedly, without knowing the most closely connected types (for instance, in the publication of geographical expeditions). It is the monographer's duty to eliminate, from these descriptions, both the commonplace and the useless. But in a monograph, the species are to be examined in a comparative manner, and relatively to the adjacent types.

to the color only a secondary importance, on account of its frequent variableness. However, there is nothing absolutely fixed in nature; the forms and the sculpture likewise vary within certain limits. Therefore the descriptions can be only averages deduced from a certain number of individuals. The description should represent, as it were, the algebraical formula of the species, or its ideal type. It is not required that this should tally with the individual, but, on the contrary, that it should represent the average of the characteristics of the ensemble of individuals. But in practice, the description can never be so perfect, since it is drawn from a certain number of individuals and not from the ensemble of the individuals that represent the species. It is for the reader to know how to seize the connection that exists between the description and the heterogeneous individuals which he may have beneath his eyes. In a word, my method of description aims above all at generalizing, and requires that the reader should generalize likewise. It can hardly suit the amateur inclined to lose himself in a multiplicity of details, for whom the collection takes the place of nature, and for whom the determination of an individual is the final purpose of the study of a species.

From the principles just laid down, it follows that in the extreme subdivisions of genera, I have usually preferred the characteristics taken from the form to those taken from the color. Undoubtedly it is less convenient for the reader, for the natural method is always less easy to follow than the empirical systems; nevertheless, I think that it is preferable to proceed in that wise, for whatever may be done to seek the natural method, a large portion of empiricism is sure to remain, as I shall endeavor to show in the study concerning the filiation of the species. We cannot, therefore, abstain too carefully from classification of empirical elements.¹

¹ It is necessary to observe on this head that no absolute rule can be laid down as to the subordination of characteristics. To be sure, forms varying less than colors, they offer, in general, characteristics more important than the latter; but there is, however, now and then a case in which the colors are more fixed than certain forms, and assume a real importance—for instance, as being the stamp peculiar to a certain geographical zone. Thus, the division *Hypodynerus* (genus *Odynerus*), which depends greatly on the colors and facies, and which comprises the most divergent forms. In this case, the livery becomes the stamp of a fauna,

DIVERSE OBSERVATIONS

CONCERNING THE

STUDY OF HYMENOPTERA IN GENERAL AND THAT OF THE
VESPIDÆ IN PARTICULAR.*Observations relative to the Synonymy.*

1st. I make it a rule always to respect the most ancient name; however, if it is wrongly constructed and if it can be rectified without inconvenience, I do not scruple to correct it. Thus I spell *Rhynchium* instead of *Rhygchium* Latr.—*Odynerus Bustelloi* instead of *O. Bustellos* Sauss., etc.

2d. When two different names have been affixed at the same date to the same species, I prefer that of the two which has been employed by the next subsequent author.

3d. I add the name of the author of a species *only to its specific name*. Consequently when the genus changes, I nevertheless maintain for the species the name of the author who first named it. Thus, I write: *Odynerus 4-dens* Lin., although Linnæus has described this species under the name *Vespa 4-dens*.

Montezumia Leprieurii Spin., although Spinola has described the species under the name of *Odynerus Leprieurii*.

Otherwise no author's name would long keep its ground; besides those who act differently do so in order to substitute their own names for that of the primitive describer. Such a proceeding cannot be too strongly censured.

Let it not be said that there are drawbacks to the advantages of that nomenclature, for if it be desirable to know the complete name as given by the first author, it will be found, such as it is, in the synonymy.

4th. I admit neither *collection* names, nor *manuscript* names, nor *in letteris* names. I admit for author's name only the name of him who has first described the species or genus.

Any other manner of acting becomes the source of profitless research and of waste of time. Whoever is anxious to affix his

and is very important. In the succession of species it is generally observed that the colors vary much, even when the forms remain fixed (or vary less); but there are other cases in which it is color that remains stationary whilst the forms vary.

name to a species that another has the task of describing, may for this purpose publish previously a short diagnosis under his name in any journal.

Observation relative to the Types in Description.

In insects in general, the female represents the type of the species. Though, in exceptional cases, the male may be the larger, the more beautiful, and at times with unusual appendages, he remains always more variable than the female. Among the Hymenoptera, the males have hardly any other part to play than a passive one; the other sex it is, which alone develops that remarkable activity which manifests itself in the interesting habits of these insects. The females are larger and more stable in their forms and colors. The slightest examination renders it apparent that it is among the females the type of the species is to be sought for, and by no means among the males. In the Vespidae, especially among the Solitary Wasps, the males are small and variable; at times, one would be inclined to consider them as abortions; they do not offer us good differential characteristics as the females, and they are to be determined only by the tentative method in referring them "de visu" to their respective females.

There exists a number of species of which the males resemble each other so far as not to be distinguishable. This may be seen, for instance, among certain *Odynerus*, but it is especially among the *SCOLIA* that this phenomenon appears in all its intensity. There is a whole category of species in the genus *Elis* of which the females offer differences the most extreme, but of which the males are so confounded that they cannot be distinguished from each other. What is most remarkable on this score is, that these species are to be found spread over every continent, and that each continent numbers several of them. Thus:—

America : *Elis plumipes, limosa, trifasciata, dorsata*, etc.

Africa : *Elis collaris, capensis, elegans, africana, fasciatella*, etc.

Asia : *Elis thoracica, annulata, marginella, limbata*.

Australia : *Elis radula, Z-cincta*, etc.

Europe : *Elis villosa*.

Some of these species may doubtless be distinguished by their size (*E. villosa*), or by the examination of their wings (*E. Z-cincta*); but in most cases, if it is not known where they come from, there is no possibility of determining them, not even of referring by sight to their females.

The same fact may be noticed in a very developed state among other species of *Elis* which present another system of coloring, and which forms a part of the subgenus *TRIELIS*. Thus the

Elis interrupta (Europe)—*texensis* (Texas)—*Xantiana* (California),

though offering females very different from each other, coincide in the males.

I do not pretend to affirm, however, that all these males are perfectly identical. I only mean that they are so close neighbors that I have not succeeded in finding between them differential characteristics which appear to distinguish them.

The preceding will suffice to show that the female ought, at all events, to be taken as type of the species.

Preparation.

In a great many collections, it is usual to spread the wings and legs of the hymenoptera. This is mere amateur's work, of no utility for study, sometimes even quite opposed to the purpose in view, by dissimulating the character of the insects instead of exposing it to view. This practice is to be regretted, moreover, by its increasing the value of the insects, on account of the time and expense wasted thereby, so that one is loath afterwards to place them in the softener when it becomes necessary to dissect the mouth.

It is usual with me to prepare each of my insects only when about to study them, because by so doing I can, after having softened them, give them whatever arrangement may be best calculated for bringing into relief such special characteristics as are particularly useful in the group to which it belongs. As the useful characteristics are not the same in each group, the preparation ought to vary according to the species. Of the *Epipona* ♂ the mandibles are to be opened, the legs to be stretched downwards, so that it may be possible to examine distinctly the haunches and thighs; of the *Odynerus* ♂, approximate to the group of *O.*

nasidens, the antennæ are to be lengthened out, in order to judge of their terminations, etc.

For almost all the Solitary Wasps, but particularly for the *Odynerus*, it is essentially necessary to be able to distinguish clearly the characteristics of the metathorax. Now this cannot be effected otherwise than by separating the wings in a transverse direction or rather downward, and by bending the abdomen downward as far as possible, the basis of which will, by this means, become at the same time easy to study. This posture is, evidently, very different from that given to the insects by spreading them out. I can affirm, that, whenever one has neglected to give the insect this posture, the metathorax and the abdomen present themselves under the most delusive aspect, and may give rise to the most serious misconceptions. As to describing an *Odynerus* properly without having taken this precaution, it is an impossibility. One may, if need be, bend downwards the abdomen without softening the insect; but then, if the wings are directed backwards, even obliquely, they are enough in the way to produce delusive appearances when the magnifying glass is used.

These observations, true especially for the *Odynerus*, apply likewise to all the sessile ventrated or semi-pedicellated Vespidae.

On the Determination of insects.

There are two manners of proceeding, for the determination of insects. One is analytical, the other synthetical, the former employed by amateurs, the latter by naturalists. The first method consists, when having taken an individual insect, in turning over the leaves of a book in search of the name of the species till one supposes to have hit on the description. This method seldom leads to certainty, often to error.

The second method requires a collection as numerous as possible in individuals. To procure it, the entomologist ought before all things to devote his efforts to a persevering and active chase after specimens. The greater the number of the representatives of each species, the more certain the determination will become. In difficult performances, we must always begin with the more easy and proceed from the simple to the complex. We must, therefore, start by separating the most salient and most easy genera to

study them first. Afterwards we must continue by way of elimination. As it is for the difficult genera, that it is especially important to adopt a good method, let us choose, for instance, the genus *Odynerus* and its approximates; it surely will answer our purpose thoroughly. Let us suppose that the pedunculiventrated genera have already been separated and that we have remaining only the sessiliventrated, say the genera *Alastor*, *Monobia*, *Pterochylus*, *Odynerus*.

First we will exclude the *Alastor*, by the process of viewing of the wings. Scarcely any other will remain than the *Odynerus* and the *Monobia*; their species will at first appearance strike one as an inextricable jumble.

For the moment, we will not trouble ourselves about the *Monobia*, which are rare and southerly species. We will, therefore, begin by confining ourselves to setting aside the *Ancistrocerus* and the *Symmorphus*, characterized by the suture of the first abdominal segment, and we can then enter directly on the study of the species. But even here we will advance as far as possible without the assistance of books.

The next operation consists in sorting out the males and females in order to occupy ourselves exclusively with the latter. With a little practice this separation proceeds rapidly, since the males of the northern regions are distinguishable mostly by their entirely yellow clypeus. For whatever may concern the exceptions (either from the females offering the same character, or from the males not offering it) one has still as object of consultation, the form of the antennæ, organs which in most males are more generally terminated by a hook or a spiral. At last, as a final resource, and as an infallible means, we remove all doubts by counting the number of abdominal segments. The ♂ have only 7, the ♀ only 6.

We will first occupy ourselves only with the ♀ and will group the individuals by species on small boards. This is a work of time and patience. To succeed, we will make use of every appreciable characteristic, even of the most empirical ones. In sorting out in this manner, the colors are always of the greatest assistance because they are obvious to the eye. One must, as much as possible, subordinate the importance of the spots to a graduated order, in beginning with the most fixed and character-

istic, as for instance the spots on the scutellum and of the post-scutellum. Thus :—

Range together all the species with post-scutellum alone yellow.
“ “ “ “ “ scutellum alone spotted yellow.
“ “ “ “ “ scutellum and post-scutellum both spotted, etc.

Then come the anterior and posterior borders of the prothorax; then the stripes of the abdomen, the spots of the metathorax, etc.

Thus you come to form more species than are really existing, every variety becoming a species; but, no matter, the work of reducing will at last arrive and will be easily carried through when species shall have been studied and known, as it were, by heart.

Then we may look into books and try to determine each species while having, beneath one's eyes, the ensemble of individuals.

Here we can get on only by groping about a long time in uncertainty. Often after comparing these similar individuals we shall detect two species which at first had been confounded.

The determination can be carried on by two inverse proceedings. After having sorted out apart by one's own observations the greater number of species, the entomologist often knows them already sufficiently to guess to what species such and such a description belongs. He can, therefore, either start from a species and seek the description which suits it, or start from a description, and in passing in review his series seek to what species this description is adapted.¹ Moreover, these two manners of proceeding verge into each other repeatedly, when one has beneath one's eyes, a large ensemble of well-separated species. Indeed, when making use of the first proceeding, one often falls into the second, for one is often struck with the description of such and such a salient character which one recollects having observed in a species. Thus the search after one species leads to the determination of another. The work hastens along with accelerated motion and leads to results the more certain as each species is represented by a larger number of individuals comprising most of the possible

¹ For this purpose short descriptions, i. e., *diagnoses*, which may at once be committed to memory, are very useful.

varieties. In this entirely empirical labor, any process, even expedients are allowable.

Nevertheless, when one gets to the groups, in which the species lie close together, one is often puzzled, and there remains no way of exclusion.

Once the females determined, proceed to an analogous sorting out and grouping of the males by species. Attribute to each female species its respective male, beginning by the more easy and proceeding always by way of exclusion. This is a tentative work, in which one succeeds satisfactorily only when familiarized with a group which is being studied.

As to separating at the outset the *Monobia* from the *Odynerus*, the *Symmorphus* from the *Ancistrocerus*, the *Odynerus* from the *Epipona*, that cannot be done without being well acquainted with these groups so as to place therein at once the insects according to their facies. If one is not far enough advanced to do so, this separation will result quite naturally from the work of determination; nevertheless, to distinguish the *Monobia*, it will be necessary to dissect the mouth.

With that operation, we may finish, because we shall have no more to seek but among a small residue of species, whereas had we begun by establishing that distinction, we should have been obliged to dissect the mouths of all the *Odynerus* which have been excluded from this operation by the mere fact of their determination. A work of determination made according to this manner of proceeding will afford synoptical views that alone will permit one to appreciate the true relations of species. Better than any other, it will prepare the entomologist to give comparative descriptions taken from a general point of view which will not lose itself in worthless details.

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VESPIDÆ

OF

A M E R I C A.

FAMILY VESPIDÆ.

CHARACTERS.—Wings folded longitudinally when at rest. Prothorax extended backward as far as the origin of the wings.

Mouth. Mandibles variable. Lip quadrifid or quadrilobed, sometimes only bifid; labial palpi not having more than four articles; maxillary not more than six articles.

Antennæ elbowed, forming either a lengthened or a subfiliform club, composed of twelve articles in the females, and thirteen in the males.

Eyes emarginate (except *Paragia*).

Abdomen sessile (without apparent petiole) or pedicellate, composed of seven segments in the males and of six in the females, and armed with a retractile sting.

Legs slender, without hairs.

Wings always presenting two recurrent nervures and three or four cubital cells. Both sexes are always winged.

The *Vespidæ* are easily recognized by their folded wings (when at rest). It is true, this character is not always very distinct, especially among the *Masarinæ* and *Raphiglossinæ*, but in this case one identifies them with certainty: 1st, by their elbowed antennæ; 2d, by their prothorax, which, instead of forming a knobbed or transverse collar, offers a distinct upper surface, prolonged on each side as far as the wing scales;¹ 3d, also by their

¹ As among the *Pompilidæ* and *Pepsidæ*, from which they are distinguished especially by their elbowed antennæ, prolonged into clubs, by their folded wings, etc.

general appearance, which is much more easily detected than described.

The habits of the *Vespidæ* are quite different; some being social, some solitary, living by rapine, and some parasitic.

These three moral tendencies correspond to the special forms which characterize the groups, into which we have separated the following subfamilies:—

I. *MASARINÆ*, or *Parasitic Wasps*.—Wings having an indistinct duplication. Antennæ sometimes enlarged into a club, their last articles often soldered together. Prothorax generally convex before. Scutel superposed upon postscutel. Claws of tarsi generally unidentate; posterior and intermediate tibiæ terminated by two articulate spines. Lip quadrid or bifid. Wings having but three cubital cells. Eyes slightly emarginate.

II. *EUMENINÆ* or *ODYNERINÆ*,¹ or *Solitary Wasps*.—Wings having a more distinct duplication, always offering four cubital cells. Antennæ subfiliform, with the articles distinct. Lip lengthened, quadrid. Claws of the tarsi unidentate.

III. *VESPINÆ*, or *Social Wasps*.—Having the same characters as the Eumeninæ, but the claws of the tarsi not toothed; the wings always having a very distinct duplication; the lip short, quadrilobed.

The *Masarinæ* can easily be distinguished by the inner neuration of their wings, etc.; but the solitary and social wasps present so few distinctive general characters, that they are always puzzling. It will hardly be deemed superfluous to give here a table of empirical characters which may assist in distinguishing them in every case.

¹ In my "Études sur la Famille des Vespides" I have given to this tribe the name of *Eumeniens* (*Eumeninæ*), after the oldest genus of the tribe. But as the genus *Odynerus* is much more important, and as the tribe *Vespinæ* is named after a sessile genus, I have thought best to adopt in preference that of *Odyneriens* (*Odynerinæ*) for the sake of conformity in the names of both tribes.

<i>Solitary Wasps. (Odynerinæ.)</i>	<i>Social Wasps. (Vespinæ.)</i>
Mandibles often long and sharp, or having <i>lateral teeth</i> . Labial palpi with three or four articles. Maxillary palpi with three, four, five or six articles.	Mandibles always short and obliquely truncate, with <i>the teeth rather terminal</i> . Labial palpi always with four articles. Maxillary palpi with five or six articles.
Eyes always extending to the base of the mandibles.	Sometimes an open space between the base of the mandibles and the eyes.
Thorax always wide and truncate before.	Thorax sometimes strongly contracted before.
The second abdominal segment always the largest, widening like a bell, and like a socket to those following.	The second segment sometimes funnel-shaped. The third segment in that case the largest and a sort of socket for those following.
<i>Clypeus</i> variable, emarginate, bidentate, truncate or rounded on its inferior border; never terminated by a tooth.	<i>Clypeus</i> often cordiform, terminated by an angle or sort of tooth or by a rounded lobe.
Second cubital cell always narrowed toward the radial.	Second cubital cell sometimes square.
The second recurrent nervure sometimes received by the third cubital cell.	The second cubital cell always receiving the two recurrent nervures.

TRIBE MASARINÆ.

(Parasitic Wasps.)

Among these insects one notices in the antennæ a tendency to consolidation of the articles and to a rudimentary condition of the maxillary palpi, as in general among parasitic insects. The abdominal segments among some species are constricted at the base so that one cannot receive another within it.

The wings often fold with difficulty; they offer but three cubital cells, and the two recurrent nervures always terminate upon the second.

The lip is at times quadrifid, and sometimes bifid. When bifid it is also extensile by virtue of a peculiar mechanism.¹

We know as yet but two representative genera of this tribe in America—one of which forms a genus limited to this continent.

¹ See: Saussure, *Etudes sur la Famille des Vespides*, III, 23, etc.; and *Annales des Sciences Naturelles*, 1857, VII.

Gen. **TRIMERIA** SAUSS.¹

Antennæ clubbed, lengthened; the last articles very indistinct. *Lip* not extensile, tongue shaped, bifid. *Labial palpi* composed of three articles; maxillary apparently of none. *Mandibles* tolerably sharp. Abdominal segments constricted at their base; not retractile.

1. **T. americana** SAUSS.

Erinnys americana SAUSS. Ann. Soc. Ent. Fr. 3d ser. I, Bull. xx, 1853.—

Trimeria americana SAUSS. Vespides, III, 1854, 81, Pl. iv, fig. 2, ♀.

Hab. Brazil.

Gen. **MASARIS** FAB.

Antennæ of ♂ long, of ♀ short, composed of twelve articles, of which the five last are soldered into a single bare mass (leaving but eight articles apparent). Articles 4–7 long in the males, short in the females, and incompletely soldered; the terminal mass (8th article) forming an oval club in the male, variable among the females. *Lip* extensile; the tongue bifid, inclosed in a contractile sheath, in the form of a lamina, placed edgewise: labial palpi short.² *Jaws* short; maxillary palpi rudimentary. *Mandibles* short, arcuate, bidentate. *Chypeus* notched like the arc of a circle. *Metathorax* flattened behind (bispinose). *Abdomen* flattened beneath, the segments contracted at the base, the third and following not retractile into the second; the abdomen equally wide and rounded at tip in the ♀; lengthened in the ♂, attenuated toward the end, bifid at the anus, and segments 2–3 armed beneath with a salient process.

¹ I at first named this genus *Erinnys* in commemoration of a discussion upon the antennæ of *Musaris* which for a long time occupied the Entomological Society of France (see *loc. cit.*); but finding this name already employed, I changed it to *Trimeria*, which seems scarcely better, as there are already two genera *Trimera*. Nevertheless I think it better to retain the new name, since it is not identical with the last.

² See for the composition of the lip, Sauss. Vespides, III, 23, and *Annales des Sciences Naturelles*, 1857, VII.

This remarkable genus counts as yet but five representatives, of which two are African, the others were recently discovered in North America.

The American *Masaris* differs from the African by having the labial palpi much longer. The 1st joint long; the 2d very short, about one-third or one-fourth the length of the first; the 3d arcuated, a little shorter than the first, and ciliated at tip. The 4th is quite rudimental, soldered to the inner face of the extremity of the third. The tongue is quite extensile as in the African type. The maxillary palpi are also quite rudimental, only apparent as a little tubercle. The American *Masaris* are also distinguished from the African by the antennæ of the ♀ which are more globularly clubbed, nearly as in *Celonites*. The males which I can only judge by the figure given, have also the terminal part more globular or at least less elongated than in *M. vespi-formis*.

1. Antennæ of ♀ clubbed, having 5 soldered terminal articles, slightly dilated, not forming a distinct knob; the first article very long. Labial palpi very short
M. vespi-formis LATR. (North Africa.)
2. Antennæ of ♀ terminated by a knob, as well as those of ♂; the five last articles forming an oval dilated mass. Labial palpi moderate.

1. *M. vespoides* CRESS.—Nigra, flavo variegata, abdominis segmentis late flavo-fasciatis; fasciis 2-5 utrinque nigro-maculatis; 6^o segmento flavo-bimaculato; alis flavescentibus; scutello planato metanoto bis-pinoso; antennis ♂ elongatis, articulo primo brevi, globoso, ultimis 5 in clavam ovalem glutinatis; ♀ brevibus, primo articulo tertio brevior, 3^o elongato, 4^o, 5^o mediocribus, ultimis 5 in clavam subglobosam glutinatis; abdomine ♂ apice fisso, segmentis 2-3 subtus processibus 2 instructis.

Masaris vespoides CRESSON, Proc. Ent. Soc. Philad. II, 1863, 69, Pl. iv; III, 673.

♂. Total length, 9 lines; expanse of wings, 15½ lines.

♀. Total length, 8 lines; expanse of wings, 14 lines.

Male.—Clypeus subquadrate, deeply emarginate, with the angles rounded; mandibles somewhat obtuse, with two indentations near the apex. Antennæ a little longer than the head and

thorax; 1st joint short and thick, 3d to 6th about equal, somewhat flat; 7th shorter, the 5 apical joints soldered into a broad oval knob, slightly concave beneath; the sutures somewhat distinct beneath. Metathorax forming on each side a somewhat flattened square angle, armed with an acute spine. Anterior femora rather curved and tibiæ dilated; posterior tibiæ armed with two spurs, one of which is elongate and deeply bifid. Tarsal claws simple. Abdomen elongate, convex above, gradually narrowed posteriorly; apical segment subquadrate, deeply emarginate at the apex, with two longitudinal carinæ, each bearing a small obtuse tubercle on the posterior third of the segment; 2d and 3d segments beneath with a bifid projection at their base; that of the 3d very prominent and armed posteriorly with an acute spine.

Body black; clypeus, apex of the labrum, middle of the mandibles, a transverse dilated line between the antennæ and the inner and outer orbit of the eyes above the antennæ, yellow; antennæ above, with the base of the first and second joints black; the apex of 1st, inner side of 2d, and the 4 following joints, yellow; the apical joints yellowish, varied with fuscous, blackish beneath. Anterior margin of prothorax, a spot beneath the wings, wing scales and a spot above, apex of scutellum and angles of metathorax yellow. Legs yellow, at base black. Each segment of the abdomen above with a submarginal yellow indented band; apical segment with a quadrilobed yellow spot. Wings stained with yellowish, nervures honey yellow about the base, fuscous toward the apex.

Female.—Form shorter. Clypeus widely and deeply emarginate, very coarsely punctured, roughly folded and reticulate at the top. Labrum carinated, elongated and rounded at tip. Forehead carinated transversely between the antennæ. Head and thorax densely, metathorax finely punctured; scutellum polished. Mesothorax carinated. The thorax depressed; the angles of metathorax flattened and depressed, terminating in an acute spine. Abdomen finely punctured; the segments very little constricted at base. First joint of the anterior tarsi rather dilated.

Black, with fulvous pubescence. Antennæ fulvous; the 1st and 2d joints blackish, the 1st yellow at tip; the club obscure on the upper side, blackish at tip. Palpi, the middle of mandi-

bles, borders of labrum at base, a transverse line at top of clypeus and orbits of the eyes behind and over the emargination, yellow. Anterior border of prothorax and sometimes also the posterior edge, tegulæ, a spot under the wings and the angles of the metathorax, yellow. All the abdominal segments bordered by a wide yellow band, the first beneath interrupted; the three following more or less emarginate in the middle, and with a black transverse spot on each side. Anal segment with two yellow maculæ. Feet yellow; black at base. Wings a little grayish, with basal and costal veins ferruginous. Radial cell having its greater width in the middle of its length; 2d recurrent vein inserted after the middle of the border of the 2d cubital cell.

The yellow ornaments of ♂ vary much in form and extent; still more in ♀, the bands being of very different width, emargination, spots, etc. The bands are sometimes emarginated in middle, and even interrupted on each side by the emargination. Sometimes the fascia at head and thorax are divided into several dots.

Var. a. Sides of clypeus and labrum not margined with yellow; no spot on the mandibles; a yellow spot at top of clypeus.

b. No yellow spot beneath the wings, no spots on mesothorax.

c. Metathorax with posterior angles slightly produced and tipped with yellow.

This insect differs from *M. marginalis* by its very rough clypeus, by the carina of the forehead, its depressed thorax, by the spines of metathorax, etc.

It has much resemblance to *M. vespiiformis*; but the knob of the antennæ of the ♂ is shorter; the projections of the 2d and 3d ventral segments are also differently constructed, that on the 2d segment of the American species being less developed and bifid, while that of the 3d segment is strongly developed, bifid, and bearing an acute spine behind. The antennæ of the ♀ are very different; the 1st joint being shorter than in *M. vespiiformis*, and the apex more swollen, as in *Celonites*. The color and distribution of the markings of ♀ is also very different, *M. vespiiformis* ♀ having its ornaments rufous and much more developed. Nevertheless the two species are so closely allied, that it is impossible to separate them generically.

Inhabits Rocky Mountains, Pike's Peak. (Coll. Ent. Soc. Phila.)

This fine insect was discovered by W. J. Howard, and described by E. T. Cresson. Numerous individuals were taken by Ridings in Colorado Territory on a plant allied to *Lobelia*.

2. *M. zonalis* Cress.—Nigra, fusco-hirta; antennarum articulis 4, 5 brevibus; clypeo arcuatim emarginato; thorace parum depresso; scutello carinato; metanoto utrinque canthum compressum longe spinosum efficiente; corpore valde sulfureo-variegato; abdomine fasciis completis 5; ano bimaculato; alis subferrugineis. ♀.

M. zonalis CRESSON, Proc. Ent. Soc. Philad. III, 1864, 674, 2. ♀. ♂.

♀. Total length 15 mill.; wing 8-9 mm.

♀. Clypeus notched in arc of circle, convex, finely punctured. Labrum triangular, rounded at tip, pubescent, with fulvous hairs. The whole insect very finely sculptured. Thorax but little depressed. Metathorax flattened behind, but not depressed; the angles compressed into strong carinæ, armed on each side with a long spine, as in *M. vespoides*.

Black, with brown hairs. Antennæ fulvous; scape black, with a yellow spot; 2d joint black; 3d yellow; those following very short; the club blackish above. Mandibles, a spot in the forehead, the whole orbits, the hind margin of prothorax, and (partly or completely) the fore margin, a spot under the wing, tegulæ, post tegulæ, margin of scutellum and the angles of metathorax, sulphur-yellow. A complete and regular submarginal fascia on all the segments of the abdomen; beneath, only lines of maculæ; 6th segment above, with two yellow spots. Feet black at base, yellow from the knees to the end. Wings as in the preceding, with ferruginous veins; radial cell rather brown; 1st recurrent vein inserted nearly at the inner angle; the 2d about in the middle of the 2d cubital cell.

Var. A yellow spot on the clypeus; 2 spots on the forehead; antennæ more black; a yellowish tip on the coxæ. Fasciæ of the abdomen a little emarginated; the band of the 6th complete.

♂. A larger subquadrate spot beneath the insertion of the antennæ, and the clypeus and labrum pale yellowish-white. Clypeus shaped like that of *M. vespoides* ♂, but more flattened and less deeply emarginate at tip; antennæ rather longer than head and thorax, proportioned as in *Vespoides* ♂, except that the club is not at all flattened beneath; the joints pale yellowish-

white above or rather exteriorly, the two basal joints more or less black above at base, the fourth, fifth, and sixth joints at tip beneath, and the whole of the remaining joints beneath, pale fulvous; the club above at tip, more or less black; the five articulations of the club are closely soldered together, the sutures indistinct. Wings as in *M. vespoides* ♂. Legs shaped as in *Vespoides* ♂, except that the anterior tarsi are scarcely ciliated, and the basal joint of the posterior tarsi is scarcely as long as the four remaining joints together, shaped like that of *Vespoides* ♂; shining black; all the segments except the terminal one, with a continuous pale lemon-yellow band; those on the five basal segments more or less emarginate on each side anteriorly; the band on the sixth segment generally entire; apical segment black, polished, deeply bifid or forked at tip when viewed from above; when viewed in profile the tip is rather broad and obtusely emarginate, the lower process being the shortest and stoutest; when viewed endwise the tip has a subtriangular shape, concave, more or less lemon-yellow, with the lower process rather deeply emarginate; venter flattened, shining black, most of the segments with a lateral yellowish spot; the second segment with a more or less developed fold anteriorly, obtusely emarginate on the middle; on the disk of the third segment a large, robust, well-developed process, obtuse at tip, but with a short, stout, subacute spine posteriorly, similar to that of *Vespoides* ♂, but less developed. Length 5 lines; expanse of wings 9 lines.

This species is nearly the miniature of *Vespoides*, but is nevertheless a very true species.

The male differs from that of *M. vespoides* in several points of structure, viz., the club of the antennæ is rounded and not flattened beneath, the basal joint of the posterior tarsi is scarcely as long, while in *Vespoides* ♂ it is almost twice as long as the remaining joints; the apical segment of the abdomen differs much from *Vespoides* ♂, in having no carinæ on the disk, and in the tip being much more deeply bifid, both above and beneath, and the projection on the third ventral segment more robust, and not compressed or emarginate at tip as in *Vespoides* ♂.

In the ♀ the thorax is less depressed, but a little more than in *marginalis*. The yellow ornaments are more abundant; the abdominal fasciæ entire. The scutellum is carinated, while it is

not in *Vespoides*; the fore part of the mesothorax is also carinated, but the hind part is depressed, while in *Vespoides* it is rather elevated. The 4th and 5th joints of the antennæ are quite short, while in *Vespoides* the 4th is longer than broad.

Hab. Rocky Mountains, Colorado Territory.

Mr. Ridings discovered this species in August on a plant most likely to be of the genus *Phacelia*.

3. *M. marginalis* CRESS.—Nigra, tenuissime punctulata; thorace quadrato, haud depresso, angulis metanoti compressis, haud spinosis; macula frontis, marginibus pronoti, tegularum abdominisque segmentorum 1–5 margine luteo; tibiis et tarsis luteis. ♀.

M. marginalis CRESSON, Proc. Ent. Soc. Philad. III, 1864, 677, ♀.

♀. The whole insect, including the head and clypeus very finely punctured, coriaceous. Thorax quadrate, a little longer than wide, not depressed as in *M. vespoides*, very finely punctured, a little rougher along the anterior margin of mesothorax. Clypeus convex, not carinated, not so much emarginate as in *Vespoides*. Labrum triangular, with the tip truncate and rounded; its margin and pubescence fuscous. The angles of metathorax not depressed, but compressed, not spined. Pubescence black (or grayish, when not fresh). Palpi, tip of mandibles, a line along the orbits behind and on the upper part of the sinus in front, a transverse line or 2 spots at the insertion of the antennæ, luteous. Antennæ fulvous; the 1st joint and upper part of the club, blackish; the other joint rather obscure on the upper side. Border of anterior and posterior edge of prothorax (more or less), and outer half of tegulæ, whitish. Abdominal segments 1–5 adorned above with a narrow whitish band, not quite marginal, sometimes interrupted; at least the first. Tibiæ luteous, tarsi fulvous. Wings hyaline, with ferruginous veins; radial cell pear-shaped, narrowly produced at its inner extremity; both recurrent veins inserted before the middle of the 2d cubital cell.

Var. The bands of head and thorax replaced by mere dots; clypeus with a white line; a macula on the pleura beneath the wing; anal segment with 2 white dots; the 3d segment beneath with a row of white dots.

Differs from *M. vespoides* by the finer punctuation, not rough clypeus, not carinated labrum, by its forehead without carina, etc.

Hab. Rocky Mountains, Colorado Territory.

This insect, like the preceding, was discovered by Mr. Ridings. I have a specimen of each of the three species here described through Mr. Edw. Norton

TRIBE ODYNERINÆ.¹

(Solitary Wasps.)

Nails of the tarsi unidentate. Clypeus never terminated by a tooth; mandibles long, prolonged in the form of a sharp beak, or truncate, trenchant or dentate; lip lengthened, often very long, always quadrifid, its lateral lobes forming long prongs separated even to its base and articulate.

In general, each of the four divisions of the tongue has at its extremity an opaque horny point; but in some cases these points disappear, and the lobes become very long, linear and plumose (*Synagris*).

Antennæ scarcely clubbed, lengthened, simple in the ♀; terminated in the ♂ by a hook, or twisted spirally at the extremity, or simple. Eyes strongly emarginate; thorax always wide before; metathorax not prolonged.

The abdomen is quite variable, but the second segment is always the largest; those following are retractile, and can easily be forced back into the second.

The solitary wasps have not the habit of living in society, and it is this characteristic which establishes the principal difference between the Odynerinæ and Vespinae; for those distinctions which are drawn from their organization are not of much consequence, and can be reduced to the difference of claws, which in the solitary wasps are armed with one tooth, and are simple among the social. The solitary wasps have, in fact, more carnivorous instincts. Although nourishing themselves by sucking flowers, they attack very many larvæ, spiders or other animals, to provide food for their offspring. Their larvæ are carnivorous, although the per-

¹ See on page 2 and 3 the table to aid in distinguishing the *Odynerina* and *Vespina*.

fect insects sustain themselves by sucking vegetation. The *Odynerinæ* establish their nests in holes in walls, in the hollow interior of the stems of certain plants, or in habitations which they construct in the open air, of clay or of some vegetable and gummy substances. The eggs deposited in these nests are abundantly provided with larvæ or insects stupefied and reduced to a state of living mummies by the effect of the poison of the mother. These animals so inclosed are incapable of defending themselves, but retain sufficient life to prevent decomposition, and serve for the support of the larvæ of the wasps. The nests, after having been provisioned, are carefully closed by the mother with clay, with just sufficient covering that the young insect can pierce it to escape when it has undergone its last transformation.

Certain species of *Odynerinæ* (*Zethus*) appear to manifest a tendency toward social habits; they form small agglomerations of nests which resemble a little the irregular nests of humble bees (*Bombus*), but grouped yet more confusedly. But there always prevails this difference between the cells formed by the social and those made by the solitary Hymenoptera that the first have a cylindrical inner space, while the second are rather extended masses which are not in regular juxtaposition, so that they seem more like spheres and ellipsoids joined together, than cells constructed side by side on a general plan. In other words, the solitary species never seek to form a comb, although they sometimes form agglomerations of cells. The most part of them do not construct these rough cells one upon another, but disperse them into different positions.

I. THE ANOMALIPENNES.

The first recurrent nervure received by the second cubital cell; the second recurrent nervure received by the third cubital cell.

I. *Lip extremely lengthened, bent back under the sternum; mandibles truncated obliquely, having terminal teeth.*

Genera: *Raphiglossa* SAUND.—*Stenoglossa* SAUSS.

Not known to be represented in America.

II. *Lip shorter; Mandibles moderately long, sharp.*

Gen. **GAYELLA** SPIN

Mandibles forming a beak by their union; labial palpi composed of four articles; maxillary, of six. First segment of the abdomen contracted in the form of a knob or an inflated disk.

1. Gayella eumenoides SPIN.

Gayella eumenoides SPINOL. Gay's Fauna Chilena (Hist. fisica de Chile), Zool. VI, 1851, 333, 1, pl. ii, fig. 2.—SAUSS. Vespides, I, 1852, 6, pl. viii, fig. 4.

Hab. Chili.

II. THE NORMALIPENNES.

The two recurrent nervures received by the second cubital cell.

Legion I. **The Zethites.**

Mandibles short, obliquely truncated at the extremity, with teeth placed on the oblique border of the truncation, and so rather terminal than lateral (*vide* Saussure, Vespides, I, pl. ii, 1c, 3c; pl. iii, 1c, 3c); forming by their union an obtuse beak.

Gen. **ZETHUS** FABR.

Mandibles short, *obliquely* truncated, and in general armed with teeth placed on the oblique terminal border. Lip and jaws lengthened; labial palpi composed of 3–4 not feathery articles; the maxillary, of 6.

Head large, expanded, in general wider than the thorax, discoidal or wider than long, swelled behind the eyes and emarginate like an arc of a circle on its posterior face. Antennæ inserted in the middle of its height. Clypeus rounded or in a large square, in general wider than long.

Thorax slightly contracted before, sharply truncated on its anterior extremity, so that there is a space in the form of a circle between the head and anterior border of the prothorax; this last generally flanged, carrying a crest in form of a sharp plate or edge.

Abdomen pediculate; the first segment in the form of a petiole, linear at its base, next inflated, and finally more or less contracted at its extremity, which renders the inflation globular or elliptical. The second segment, in form of a rounded bell, is often pediculate.

Sexual differences.—The males have the clypeus transverse, quadrate, broad. Their antennæ are terminated either by a hook, or by a spiral.¹ The females have the antennæ simple and the clypeus discoidal, often convex or lozenge-shaped, transverse.

Insects American.

This genus is easily recognized by its peculiar face, its transverse clypeus, large head, and the singular form of its abdomen.*

Among the *Zethus* the mandibles are quite short, overlapping beneath the clypeus; their triturating edge is terminal, not lateral as among the *Eumeninæ*.

The size of the head is such that the eyes do not entirely cover the cheeks. The metathorax has such variable forms that it recalls what one sees in the *Odynerus*; one can always here distinguish two lateral ridges, which extend from the base of the wing to the insertion of the petiole, as in certain *Odynerus* (*Hoplopus* or *Epipone*).

The petiole is quite variable. Its expansion produces a form sometimes globular, sometimes more lengthened. The 2d abdominal segment, whether subsessile or long pediculate, has the form of a bell or compressed oval. It is dilated suddenly (globularly), or gradually (like a pear). Its posterior border always presents two distinct foliations, the inferior projecting remarkably. This

¹ It is not possible to establish a definite limit between these two forms: for often, with the hook, there also commences a spiral. When the spiral is very distinct, the 13th article, in place of terminating in a point as when it forms a hook, is lengthened, curved and obtuse. (See Saussure, *Vespides* I, pl. ii, fig. 3, d.)

² The *Zethus* were mostly confounded with the *Eumenes* up to the time when I reunited the species in one genus, of which the buccate characters and the general form are too distinct to admit of any confusion. But I could not entirely separate from the genus *Eumenes*, some species which I had not seen, and of which, even as wasps, the descriptions were incomplete (*E. rufinoda* LEP.; *E. substricta* HALD., etc.).

form of the two first segments recalls specially that of *Icaria* (Social Wasps).

In general with *Zethus*, above all among the small species, the head and thorax are cribrate with coarse punctures. These sometimes extend upon the petiole, but commonly the metathorax is less punctured and the abdomen very smooth.

Most of these insects are colored black and yellow; but the yellow markings are often wanting, and the variations are very numerous.¹

The genus *Zethus* is particularly interesting in view of its zoological affinities. In fact, here the head becomes large and excavated posteriorly, as in the *Vespinæ*; the mandibles are short as among them; and one remarks a certain relationship in the appearance or some resemblances which seem to establish an affinity with the Social Wasps;² while in the construction of the parts of the thorax, one recognizes some traces of the forms of the *Odynerinæ sessiliventres*.

Zethus seems also to establish a lien between the *Odynerinæ* and the Social Wasps by their habits; for the *Zethus*, although certainly solitary insects, construct nests composed of irregular cells, few in number but agglomerated, which is probably a preliminary step in the series toward the construction of numerous serried and regular cells. (See *Zethus Romandinus*.)

Even with all the gradations of form which we observe in passing from one to another in this genus, we do not think that one can divide the *Zethus* into more genera. Even the Asiatic type *Calligaster* seems so intimately attached to *Zethus* that we can scarcely keep it separated now that more numerous Asiatic species are known.

In conclusion, the genus *Zethus* is a very numerous American group, peculiarly abundant in the intertropical parts of this continent. In the United States it is represented by but one known species; while in Mexico we find a very great number, which seem to be but an indication of a very much greater number which must exist in the other parts of tropical America.

¹ From my ignorance of this fact, I regret having published in my *Monographie des Guepes Solitaires*, descriptions of a certain number of species of *Zethus*, the distinctions of which are founded especially on the distribution of colors.

² See below, the division *Zethus*.

This circumstance promises to render the study of the species exclusively difficult.

Division ZETHUS¹ (*sensu strictiore*).

(SAUSS. *Vespides* I, 9, III, 115.)

Second abdominal segment subsessile; expansion of the petiole globular, lengthened. Thorax moderately lengthened. Metathorax convex, presenting two rounded convexities, separated by a groove. Antennæ of the males terminated by a spiral. The 6th abdominal segment bearing underneath two lamellar appendages (copulative?). Species large, having a feeble sculpture, but not polished and with a dull metallic color.

It is impossible not to be struck with the resemblance of these insects to the *Synoeca*. The same form of head, indented behind, the same dull metallic color, great size, pediculate abdomen, mandibles almost the same form, etc.

The representatives of these two genera inhabit also the same countries of America. There is, in their color and appearance, one of those analogies which we sometimes find impressed upon insects of the same regions of our globe,² and this seems especially one of those openings that modern zoology should carefully mark as suitable to cast some light on the relationship of species.

1. *Z. cœruleopennis*³ FABR.

Vespa cœruleopennis FABR. Ent. syst. Suppl. 263, 1798.

Zethus cœruleopennis FABR. S. P. 282, 1.—LATR. Gen. IV, 137; Encycl. pl. 393, fig. 12, 13.—SAUSS. *Vespides*, I, 9, 1: *Revue Zool.* X, 1858, 64.

Zethus brasiliensis SAUSS. *Vespides* I, 10, 2, ♀; III, 115, ♂ (prob. variety of this species).

Zethus magnus SAUSS. *Vespides* I, 11, 4, pl. viii, fig. 5, ♂.

Abdominis petiolo globoso-clavato, sulco tenuissime partito.

Hab. South America, Cayenne, Para, Brazil, Quito.

¹ I have separated from this division a certain number of small species, which have very much the same form of abdomen, but which, by their clypeus and the angular form of the metathorax, find a more natural place in the division *Zethusculus*.

² The *Vespides* of Chili present a yet more striking example of this. See below *Hypodynerus*.

³ The *Vespa surinama* LINN. (Gmel. V, 2759, 23), is either this species or a *Synoeca*.

2. Z. recurvirostris DE GEER.

Vespa mexicana LINN. 12, Edit. 953, 6.—OLIV. Encycl. Meth. Ins. VI, 673.

Vespa recurvirostris DE GEER. Mém. III, 579, pl. 29, fig. 4, 1773.

Vespa cyanipennis FABR. Ent. syst. II, 277, 86, 1793; *Polistes cyanipennis*, S. P. 275, 30.

Zethus cyanipennis LATR. Genera, IV, 138.—ERICH. Faun. et Flor. Brit. Guiana, III, 590.—SAUSS. Vespides, I, 12, 6; III, 116; Revue Zool. X, 1858, 63.

Eumenes cyanipennis LATR. Hist. Crust. et Ins. XII, 345.

Zethus lugubris PERTY. Delect. An. Artic. 144, pl. 27, fig. 4, 1830.—SAUSS. Vespides, I, 11, 5; Revue Zool. X, 1858, 63.

Clypeo ♀ lato, satis rotundato, truncato; petiolo ovato-clavato, nigro vel rufo.

Hab. Brazil. Does not seem to inhabit Mexico.

3. Z. chalybeus SAUSS.

Zethus chalybeus SAUSS. Vespides, I, 10, 3; Revue Zool. X, 1858, 63.

Clypeo ♀ transverso, rhomboidali, utrinque acute angulato, apice truncato, bidentato.

Hab. Brazil.

4. Z. carbonarius SMITH.

Zethus carbonarius SMITH, Cat. Brit. Mus. Vesp. 10, 5.

Hab. Brazil, River Amazon.

Division HEROS.

(SAUSS. Vespides, III, 115.)

Clypeus lozenge-shaped, transverse, forming on each side a sharp lateral angle; abdomen depressed, its second segment subsessile, enlarging gradually. Head swollen at vertex, and convex. Ocelli arranged upon a very oblique, almost vertical plane.

5. Z. gigas SPIN.

Zethus gigas SPINOLA, Ann. Soc. Ent. Fr. X, 1841, 129, 80.—SAUSS. Vespides, I, 12, 7; Ib. III, 115.

Calligaster heros SAUSS.¹ Vespides, I, 23, 1, ♀, pl. ix, fig. 6, 1852.

¹ This name was given by De Haan; but it is a collective name, and after having cited Haan, for satisfaction, in the description of the species, we here suppress the name; considering that we do not recognize the collective name, as we have said elsewhere, and do not wish, by setting an example, to preserve it.

Hab. South America. Cayenne.

This type has very much the form of *Zethusculus*, on the part of its clypeus, and yet this form of clypeus appears in *Z. spinipes*.

Division ZETHUSCULUS SAUSS.

(SAUSS. Vespides, I, 15; III, 118.)

Second abdominal segment subsessile, or briefly pediculate (the pedicle having at most a quarter the length of the segment). Petiole lengthened, its inflation variable.

Species small, ornamented with black and yellow.

The insects of this group often have the clypeus armed with two little separated teeth; this part is in general moderately rounded, but is at times lozenge-shaped, as in the division *Heros*, with the lateral angles sharp (*Z. spinipes*); the head and thorax are cribose with great punctures, often rugose—the vertex offering frequently a corrugation which includes the antennæ. The thorax is generally short, and at times strongly angulate; the metathorax in particular is sometimes convex as with the true *Zethus*, and at times becomes angulate. The lateral ridges are very distinct and the flanks beneath are smooth, compared with the rest of the thorax. The posterior face of the metathorax is convex, having two convexities or moderately flattened elevations, always velvety, less punctured than the rest of the thorax, and in general covered with striæ or wrinkles, silky upon the dividing groove. Sometimes the posterior face of the metathorax is concave and offers under the post-scutel a little excavation, which recalls what one sees among certain *Odynerinæ*. One often perceives, also, two longitudinal carinæ which start from the angles of the post-scutel.¹ When these carinæ become enlarged, they produce ridges which border the cavity (*Z. miniatus*).

The petiole is quite variable; sometimes the knob is elliptical and depressed, but more often the swelling is moderately cylindrical; at first somewhat large, it then diminishes in size gradually to the extremity. In fine, it inclines to the campanular form, whether lengthened pyriform, or clubbed and calling to mind the *Eumenes* or even tubular; but the other characters always suffice

¹ When I say: metathorax bicarinate, it is meant that the carinæ exist on the posterior face of the metathorax; for as the *lateral edges* or ridges are found on all the species, I do not mention them in the descriptions.

to enable one to distinguish these exceptional species from the *Eumenes* (viz. : the clypeus transverse and not longitudinal, the mandibles truncate and not tapering, the head emarginate behind). The petiole is, in general, less strongly punctured than the thorax, more strongly than the abdomen.

Among the species of this division the antennæ of the males are terminated, sometimes by a rolled-up spiral, sometimes by a hook. They form, in this way, two parallel series, based upon this character; in each one of them one sees the second abdominal segment at one time sessile and at another becoming more and more pediculate. These two series continue in the *Didymogastra*. The two forms of antennæ combine with all the degrees of prolongation of the abdomen, thus showing that the character drawn from the manner of termination of the antennæ is not of any generic value.

As the most of the insects of this genus are not well described in my "Etudes sur la Famille des Vespides" I will here give a diagnosis of the species of Meridional America which I have before my eyes:—

A. Antennæ of the males terminated by a rolling-up spiral.

a. Petiole presenting a nodulous or ovoid expansion.

6. *Z. arietis* FABR.—Niger, capite et thorace valde cribratis. Clypeus cribratus, integer, apice subtruncatus. Pronotum vix carinato-marginatum; metanotum minus rugosum, sericeum, in medio excavatum, striatum. Petioli tumor haud nodosus, elongatus ut in *Z. Westwoodi*, at angustior, nitidus, tenuiter punctatus; abdominis 2m segmentum paulum (sed distincte) petiolatum, elongatum, ovato-dilatatum (non globoso-dilatatum ut in *Z. spinipede*, *Westwoodi*, etc.). Petiolus et pedes rufi; alæ infuscatæ cyanæ; ♂ antennis subtus apicem versus fulvis. Longit 0.017.

Vespa arietis FABR. Ent. Syst. II, 1793, 282.—OLIV. Encycl. Meth. Ins. II, 676.

Polistes arietis FABR. Syst. Piez. 280, 50.

Zethus arietis SAUSS. Vespides, I, 14, 11; Revue Zool. X, 1858, 64.

Hab. Brazil.

7. *Z. rufinodius* LATR.

Eumenes rufinoda LATR. Genera, IV, 1809, 137, pl. xiv, fig. 5.—SAUSS.

Vespides, I, 42, 19.

Zethus rufinodius SAUSS. Vespides, III, 118, 4, pl. vi, fig. 3, ♀.

May be a variety of the preceding.

Hab. Antilles.

8. *Z. piriformis* SPIN.—♀. Ater, nitidus, punctatus, sed nihilominus politus; clypeo et fronte planatis; illo apice subemarginato, margine punctato, de reliquo lævi, substriato; pronoto valde cristato-marginato, sed haud bidentato, postscutello et metanoto velutinis, argenteo-sericeis, hoc parum striato, supra utrinque lævi; petiolo ovato-inflato, nitido, punctulato, margine flavo-limbato; secundi segmenti margine subjacente producto; reliquis valde punctatis; antennis subtus apicem versus ferruginescentibus; alis hyalinis, costa anguste nigra; cellula 2^a cubitali trigonali. Longit 0.017.—Variat secundo segmento flavo-limbato.

Zethus piriformis SPIN. Ann. Soc. Ent. Fr. X, 1841, 135.—SAUSS. Vespides, I, 15, 12.

Zethus binodis SAUSS. (per errorem) Vespides, I, pl. viii, fig. 8.

Hab. Cayenne.

This species is remarkable for its body appearing smooth, although punctured, having the punctures apparently effaced. I cannot say with certainty if this is really the species described by Spinola. The 2d segment of the abdomen is swelled suddenly, and globular, a character which distinguishes this *Zethus* from *Z. fraternus*.

9. *Z. fraternus* SAUSS.—Niger, punctatus; punctis 2 frontalibus flavis. Pronotum paulum cristato-marginatum. Scutellum convexum, sulco partitum. Metanotum minus punctatum, sericeum, clunibus 2 convexis, sulco profundo sejunctis et utrinque carina verticali spatium striatum marginante instructis (non sunt illæ carinæ laterales metanoti, sed faciei posticæ). Petiolus ovatus, sat brevis, punctatus, margine flavo; abdominis secundum segmentum distincte petiolatum, ovato-dilatatum. Alæ infuscatæ, costa nigra, apice et postice parum obscuræ.
♂. Clypeus in dimidia parte inferiore flavus margine infero recto, *dentibus* 2 *distantibus* nigris; antennæ subtus, apicem versus flavæ. Longit 0.016.

Zethus fraternus SAUSS. Vespides, I, 16, 14, 1852; Revue Zool. X, 1858, 163.

Hab. Brazil (lower provinces). Typus in museo Saussuriano.

The swelling of the petiole is a little flattened, and wider than in *Z. piriformis*; the second segment is more briefly pediculate, more gradually swelled and less globular. The body is more strongly punctured.

10. Z. Westwoodi SAUSS.—Niger, capite et thorace grosse foraminato-cribratis, metanoto argenteo-sericeo; abdomine valde aureo-sericeo; petioli ampliacione ovata, elongata, haud clavata; secundo segmento petiolato; pronoti margine, macula subalari, scutellis, et abd. segmentorum 1-2 margine, flavis; alis infuscatis; ♀ clypeo integro utrinque margine flavo; ♂ clypeo flavo, antennis subtus et cochlea fulvis.

Zethus Westwoodi SAUSS. *Vespides*, I, 1852, 16, 15; III, pl. vi, fig. 2, ♀.

Total length, 18 mm.; wing, 13 mm.

♀. Clypeus polygonal, entire, covered with coarse punctures; its inferior border a little truncated and retroussé. Head and thorax covered with coarse cribriform punctures; on the forehead a feeble transverse depression, and above the insertion of each of the antennæ a vertical medial depression extending to the clypeus. Prothorax angulate; its anterior border edged by a crest in form of a vertical lamina. Post-scutel unarmed. Metathorax rounded, smooth, hairy, with little or no punctuation, and covered with a silky down, in color strongly silvery or a little golden; its excavation has its upper edges moderately distinct; the lateral edges of the metathorax prominent. Petiole smooth, shining, golden, like the abdomen: the linear part almost naked, the expansion much lengthened, oval, occupying most of its length, a little swelled above. The remainder of the abdomen shining, distinctly golden, garnished with a silky pile, having cupreous reflections. Second segment ovate-globular, pediculate, the pedicle occupying a fifth of the length of the segment; the part swelled (or the bell), wider than long, but less wide than the length of segment; the second leaf of its border very prominent.

Insect black; on each side of the clypeus an oval spot, two dots above the insertion of the antennæ, margin of the prothorax, a spot under the wing and scutels, yellow or orange. A border of this color occupies the margin of the two first segments; that of the first extending along the sides of the petiole (these markings are liable to be wanting, particularly on the head and the prothorax). The remainder of the abdomen and the second margin of the second segment, ferruginous. Antennæ and legs black. Wings smoky, the anterior borders brown with a violet reflection. Wing scales yellow or brown.

The ♂ as large as ♀; clypeus yellow, slightly bidentate (a third hardly perceptible tooth between the two laterals). Flagellum of the antennæ yellow beneath, especially under the

terminal bend, which is sometimes entirely tawny. The yellow or tawny border of the prothorax is interrupted by some black points in both sexes.

Var. Size small, 13 mill. Prothorax black.

Res. a. diff.—Approaching to *Z. aztecus*, but very distinct by the pedicle of the second segment being sensibly longer; by the petiole, of which the inflation is more lengthened, which does not form any prominence above and which is not strongly punctured.

Hab. The hot regions of the gulf side of Mexico. Tampico.

N. B.—The type from which I first described this species, *l. l.*, has the "etiquette" Peñon de los Baños, a locality of the valley of Mexico (cold region). This should be an error of the "etiquette," for I have myself taken this species in the region approaching the hotter zone of Mexico.

11. *Z. Jurinei* SAUSS.—Gracilis, niger, nitidus; capite et thorace tenuiter punctatis (punctis quasi oblitteratis); hoc nitido, metanoto brevi, albidosericeo, planato. Petiolus ovatus, valde dilatatus et maxime depressus, nitidus, vix punctatus; secundum abdom. segmentum basi petiolatum, dein globoso-dilatatum, ut petiolus nitidissimum; segmenta reliqua punctata. Pronoti margo, macula subalaris et tegularum limbus posticus, puncta 2 in scutello, maculae 2 rotundatae in metanoti parte imma, flava; abd. segmentorum limbus tenuissime albidus vel flavus. Alae infuscatæ. Longit, 0.015 mm.

♂. Clypeus flavus, sericeus, superne niger, et margine tenuissime nigro, subdenticato; antennæ subtus apicem versus fulvæ.

♀. Clypeus integer subtruncatus, niger, sublaevis.

Zethus Jurinei SAUSS. *Vespides*, I, 1852, 15, 13; III, 118; *Revue Zool.* X, 1858, 162.

Hab. Antilles? South America. Caracas. (Typus in museo Genevensi et Saussuriano.)

12. *Z. nigricornis* n. sp.—Nigerrimus, nitidus, punctulatus; metathorace et abdomine cinereo-sericeis; abdominis petioli margine et linea submarginali angusta 2ⁱ segmenti, sulfureis; alis infumatis, costa nigra; ♀ antennis et clypeo planato nigris, ♂ clypeo albido, margine tenuiter nigro; antennarum flagello subtus albido-annulato; tibiis intermediis linea albidæornatis.

♀ ♂. Total length 15 mill.; wing 10 mm.

The same form and sculpture as *Z. aztecus*. Jet black, immaculate, having only the yellow border of the petiole and a very

fine submarginal sulphur-yellow line on the 2d segment. The antennæ quite black.

♂. Clypeus *flattened*, only delicately punctate-strigate, a little trilobed in the middle of its inferior margin; metathorax not so much hollowed posteriorly; a little strigate on sides; the excavation not margined at top; the *lateral* carinæ very sharp and prolonged nearly down to the end, not obsolete beyond the angle; the lateral faces polished. The swelling of the petiole not so oval, but more attenuated posteriorly; the second segment more pediculate, so that it might be almost classed in the Division *Didymogastra*.

The body is not clothed with golden silky hair, but only with a little grayish pubescence on the metathorax and abdomen; the face or clypeus not silvery as in *Z. aztecus*.

♂. Antennæ black; all the joints of the flagellum annulated beneath at their base with pale-yellow; the first joint having its macula near the end; the scape black. Clypeus broad, quadrangular, transverse, whitish-yellow, not silvery; its inferior edge black, widely emarginate, with 2 distant teeth. The intermediate tibiæ ornamented before with a white line, running over the first joint of the tarsi.

Hab. Mexico, the eastern Cordillera. Orizaba (Mr. Sumichrast).

This species has the appearance of *Z. Jurinei*, because of its oval petiole being posteriorly attenuated, and its black shining color, but it is smaller; its petiole is not impunctate, polished, etc.

b. *Swelling of the petiole cylindrical.*

* *Metathorax not excavated.*

13. *Z. Heydeni* n. sp.—Niger, punctatus, tomento aureo ubique vestitus; pronoto cristato-marginato, sed angulis haud spinosis; petioli tumore cylindrico, subdepresso; corpore maxime flavo-variegato; abdominis segmentis omnibus tenuiter flavo-limbatis; pedibus flavis, femoribus nigro-variiis; alis pellucidis, venis ferrugineis.

♂. Mandibulis et clypeo flavis; hoc in medio margine *producto-truncato*; *antennis fulvis* sub scapo fascia flava, apice cochleatis.

Total length, 16 mm.; wing, 11 mm.

♀. Insect slender. Head wider than high, densely cribose. Thorax densely cribose; prothorax strongly flanged, but the

angles not spiny; post-scutel feebly bilobate; metathorax convex, slightly divided by a simple furrow, strongly wrinkled—its lateral edges sharply carinate. Petiole of moderate length, its enlargement not being oval but in form of a tube slightly flattened, a little compressed behind, punctured; the remainder of the abdomen pear-shaped, the 2d segment bell-shaped, a little pediculate, slightly funnel-shaped, offering a second distinct border, not turned up at edge.

The whole insect of a shining black, everywhere garnished with a pile of tawny hair; a transverse spot on the forehead, sinus of the eyes, a spot behind each eye, a large border on the prothorax, a spot under the wing, wing scales, two spots on the scutellum, a band on the post-scutel, and two large spots on the posterior face of the metathorax, yellow. Segments of the abdomen all narrowly bordered with yellow; legs yellow, thighs varied with black. Wings transparent, nervures ferruginous.

♂. Clypeus yellow, convex, terminated by a truncate projection; mandibles yellow; antennæ *entirely orange* or ferruginous, only a little dull above; the scape marked with a yellow line; the 3 last articles forming a rolled spiral.

Res. a. diff.—This species is distinguished by the color of its antennæ, and especially by the form of its petiole. This form resembles a little that of *Z. miniatus*, but that has the angles of the prothorax dentiform and the petiole more cylindric and coarsely cribose.

The *Z. Heydeni* is much less coarsely cribose than the *Z. Aztecus*, *Westwoodi*, or *chrysopterus*, which it slightly resembles; and the exceptional form of the clypeus, ♂, also distinguishes it clearly: for with these species the clypeus is large, quadrate, the same as with the *Z. Jurinei*, which is less punctured and has the wings obscure. The enlargement of the petiole is also very much more globular than among all these species.

Finally, this *Zethus* might be confounded with some one of those species described by Smith, and which we cite at the end of the genus; but the author having omitted to indicate divisions into which these species enter, or the characters which permit one to classify them with precision, it is not possible to recognize them with certainty. The *Z. curinatus* presents much the same appearance, but it is very much smaller.

Hab. Brazil. (Museum of Senkenberg.)

This charming insect was communicated to me by Mr. de Heyden.

** *Metathorax excavated; the excavation margined with sharp carina.*

† *Thorax short, quadrate or rounded.*

14. *Z. Olmecus* n. sp.—Niger, thorace crasse, metanoto crassissime foveolato-punctato; metanoto valde excavato, acutissime carinato; petioli tumore cylindrico, rugosissimo, carinato; mandibulis, clypeo, punctis 2 frontalibus, 2 scutelli et 2 post-scutelli, margineque segmentorum 1ⁱ, 2ⁱ, flavis; pronoto rufo-maculato; femoribus posticis subdeformibus.

Total length, 11 mill.; wing, 8 mm.

♀. Smaller than most of the preceding. Head moderate, covered with scattered moderate punctures. Mandibles widened to beyond the middle; the cutting border oblique, having an acute point, a rounded tooth, and an obtuse lobe. No transverse carina above the antennæ. The vertex having a little arcuate depression behind the ocelli. Thorax short; prothorax attenuated anteriorly; its anterior border crested, the crest forming on each side a little acute but not marginal angle, the anterior margin being much narrower than the rest of the thorax; the lateral parts of pronotum not margined. Scutel rather salient; post-scutel destitute of tubercles, quite truncate, having a posterior face, punctate along its superior arcuated margin. Metathorax quite angular in shape, as in some *Odynerus*; its whole posterior face occupied by a large and deep sericeous excavation margined by very sharp and prominent carinæ, starting from the angles of the post-scutel; the top of the carinæ separated from the post-scutel by a fissure; the inferior extremity of the posterior carinæ meeting the *lateral* sharp carinæ, and forming with them a sharp angle; the upper side of metathorax divided into two triangles included between the carinæ. The thorax covered with very large but not deep punctures; still larger on the metanotum, where they are nearly little grooves. Petiole having its swelling cylindrical, extremely coarsely punctured, the punctures very large and confluent; the middle somewhat carinated by the rough sculpture, the extremity a little contracted and with a large groove; on each side in the middle an obsolete sort of a tooth; the anterior extremity of the swelling truncate, polished. Second segment subsessile, convex beneath at base, but not tuberculous; tenuously

punctured, but not more on its margin than elsewhere; the third segment densely punctate; the following impunctured; the first margin of the 2d a little arcuate and depressed in the middle; the second lamellar margin of 2d and 3d segment growing a little wider on the sides; that of the 3d rather transversely cut out in the middle third. Posterior tibiæ arcuated, a little deformed.

Black, with a very dull silky reflection, rather fulvous. Mouth, mandibles, and clypeus, yellow, a little orange, or reddish at top of clypeus. Scape and the end of flagellum beneath, yellowish or tawny. Two spots over the antennæ, two lines on the vertex starting from the eyes, and two lines behind the eyes, not marginal, tawny. Both margins of prothorax and two spots on the lateral margins of scutellum, yellowish-tawny; two spots on the edges of post-scutel, the margin of petiole and a narrow yellow submarginal line on the second segment, yellow; anterior feet more or less ferruginous or yellow-tawny beneath. Wings subhyaline; veins brown; 2d cubital cell lengthened at base (on the side looking to the base of the wing).

♀. Clypeus rounded, densely and strongly punctured; a little velutinous; its inferior margin arcuate, not truncate nor emarginate; its summit a little carinate. The head beneath and around the mouth, post-sternum and anterior coxæ, sulphur-yellow.

♂. Clypeus a little wider, having the same shape and color as in the ♀. The oblique cutting border of mandibles with but 2 little notches. Antennæ tawny beneath; the last two joints obtuse, forming nearly a hook. Anterior tibiæ, tarsi, and thighs beneath ferruginous; intermediate tibiæ beneath and 1st, 2d, and 3d joints of the tarsi beneath yellow; the 3d segment slightly margined with yellow.

Var. Prothorax black, with its angles and two marks, tawny.

Hab. Mexico. The Oriental Cordillera. Orizaba (Mr. Sumichrast).

Res. a. diff.—This is a very distinct species in the remarkable form of its metathorax and the rugosities of its petiole; quite different from all other Mexican *Zethus*, except from *clypeatus*. It differs by its more excavated metathorax, the excavation being polished and more carinated, and by its prothorax, more rounded anteriorly, not square shaped nor crested on the sides; by its rougher petiole, carinated in the middle, etc. It has such an extraordinary resemblance to *Z. miniatus* that it might be

considered a Mexican variety of this; but it has the mandibles a little less indented, the petiole a little thicker and shorter; the lamella of 3d segment less cut out; and a less high coloration.

It approaches in the same way toward *Z. lobulatus*.

It differs from *Z. toltecus* by its short thorax, the carinæ of metathorax which converge on each side to a sharp angle, etc.

Its appearance is that of a true *Zethus*.

Hab. Mexico. The Oriental Cordillera, Orizaba (Mr. Sumichrast).

15. *Z. miniatus*¹ SAUSS.—Parvulus, niger, caput et thorax mediocriter profunde punctata; pronotum cristato-marginatum, angulis spiniformibus; mesonoti discus sulcis 2 profundis brevibus e scutello emergentibus notatus; post-scutellum angulatum, margine postico subcon cavo, et in lateribus cristulis 2 (ut dentibus e scutelli angulis emissis) instructum; metanotum ferrugineum maxime excavatum, utrinque crista verticali e post-scutelli angulis emissa instructum; petiolus cylindricus rugosissime cribratus; secundo segmento globoso-dilatato, subsessile. Caput fulvo sericeum, aurantiacum, fronte nigro; mandibulis et antennis aurantiacis; pronotum, maculæ subalares et scutellares, aurantiacæ; abd. segmenta tenuissime flavo-limbata; alæ secundum costam infuscatæ; pedes antici et intermediarii aurantii. Longit. 0.011 mm.

Clypeus ♀ discoidalis, ♂ subtruncatus; in utroque sexu aurantiacus. Antennæ ♂ apice vix cochleatæ.

Zethus miniatus SAUSS. *Revue Zool.* X, 1858, 64.

Hab. Para. (Typus in museo Saussuriano.)

16. *Z. lobulatus* SAUSS.

Zethus lobulatus SAUSS. *Vespides*, III, 116, 2, pl. vi, fig. 4, ♀, 1854.

Hab. Brazil. Amazon.

†† *Thorax elongate, attenuated anteriorly, elliptical.*

17. *Z. Toltecus* n. sp.—Niger, cinereo-sericeus, punctulatus; thorace elongato, depresso, antice attenuato; metanoto crassissime foveolato-punctato, 4-carinato, foveolâ quadratâ inter carinas instructo; petiolo cylindrico, rugosissimo; 2^o segmento subtus basi tuberculato; clypeo transverso, rotundato; antennis subtus, mandibulis, capite subtus, linea

¹ Perhaps a variety of the following, with the second cubital cell less retracted. In this the excavation of the border of the second segment was probably due to an accident of nature.

post-oculari, punctis 2 pronoti et scutelli, margine abdominis segmentorum 1^o, 2^o, coxis pedibusque anticis, flavis. ♀.

Total length, 12 mm.; wing, 8½ mm.

Head moderate, moderately punctured; the trenchant margin of mandibles very obsoletely lobed. Thorax *elongate* and *depressed*, polished, covered with delicate punctures, having a tendency to striæ, but the pleuræ covered with stronger scattered punctures, much attenuated anteriorly and posteriorly; its anterior margin short, margined; the disk of the mesothorax flattened, with two sulcose places at base; scutellum flattened, not divided by a sulcose basin, post-scutellum very small; metathorax elongate, oblique, triangular, very coarsely punctured (or rather reticulate-rugose); its lateral carinæ very sharp, the sides under the carinæ polished, but a little reticulated near the carinæ, posterior face having two strong carinæ, starting from the angles of the post-scutel, the extremities of which do not meet the *lateral* carinæ; the space between the middle carinæ forming a square excavation, rather widened posteriorly, polished, furnished with gray sericeous hair, as also the terminal acute angles of metathorax, behind the end of the middle carinæ.

Petiole (as in *Olmecus*) cylindrical, truncate and polished in front, extremely coarsely punctured, very rugose, a little carinated at base, the extremity marked with a semicircular groove, and also constricted on each side. Second segment of abdomen rather elongate, a little depressed, with quite delicate oblique punctures; the punctures beneath stronger, on the base swelled tuberculously; the first margin above slightly angular in the middle, the subjacent lamina very salient on the sides but very little in the middle; margin of the 3d segment arcuate, the lamellar edge strongly and broadly cut out in the middle.

Black, furnished with silvery hairs (except on the head, where they are yellowish); a line of them behind the eyes (but *not marginal*) and a line on the scape, yellow; the flagellum of ♀ beneath yellowish-ferruginous; two dots on the prothorax, two on the scutel, margin of petiole and a filiform line on the upper margin of the 2d segment, yellow; prosternum, anterior coxæ, and legs, yellow; intermediate knees and tibiæ annulated with yellowish-brown. Wings washed with brownish, with a golden reflection.

♀. Clypeus in a rounded lozenge-shape, truncate at the top and

extremity, but without angles, delicately punctured-strigate. Clypeus, mandibles, and the under part of the head, yellow.

Res. a. diff.—This species has just the same form of head and clypeus and just the same system of coloration as *Z. olmecus*; the petiole is also the same, but the thorax, lengthened, flattened, very delicately punctured, the metathorax less excavated, with not so salient carinæ, make it easy to distinguish. The middle carinæ of metathorax stop before reaching the lateral carinæ. The appearance of the insect is quite different, and it looks more like a *Discælius* (*D. zonalis*) than like a *Zethus*; and this appearance, due to the elongate thorax, distinguishes it also from *Z. miniatus* and *lobulatus*.

Hab. Mexico. Oriental Cordillera (Mr. Sumichrast).

B. Antennæ of the males terminated by a hook.

- a. *Species having the appearance of the true Zethus. Head wider than high; thorax short, not being one and a half times longer than wide; dilatation of the petiole elliptical or cylindrical, a little contracted behind; the second segment of the abdomen in form of a globular bell.*

18. *Z. spinipes* SAY.—Medius, niger, nitidus, densissime et grosse cribrato-punctatus; punctis 2 frontalibus flavis; clypeo lato, ♀ nigro, subidentato, rugose cribrato; ♂ punctato, albido, supra nigro; antennis ♀ atris, ♂ lineæ in scapo albido; abdominis secundo segmento minus conspicue punctato, subpedunculato; petiolo inflato, campanulato, grosse punctato, apice flavo-marginato.—Variat ♀ ♂ pronoto, lateribus, scutellis, albido variegatis et abdominis secundo segmento margine albido.

Zethus spinipes SAY, Bost. Journ. I, 1837, 387, ♀.—SAUSS. Vespides, III, 122, 10.

Eumenes substricta HALD. ! Proc. Acad. Phila. II, 1844, 54.—SAUSS. Vespides, III, 152, 42.

*Zethus variegatus*¹ SAUSS. Vespides, I, 13, 9, ♀, 1852; Revue Zool. X, 1858, 66.

Eumenes pensylvanica HALD. Proc. Acad. Phila. 1853, 365, ♂.

Zethus bicolor SAUSS. Vespides, I, 17, 16, ♂.

♀. Insect of medium size; ocelli disposed in a wide triangle. Clypeus having the form of a *transverse lozenge*, twice as wide as long; having the lateral extremities very sharp, and its ante-

¹ The collection, with bad locality marks, of M. de Romând, has led me into very many errors.

rior border armed with two little distant teeth. Head extremely dilated at the vertex, strongly excavated behind, wider than the thorax. Thorax very short, not being one and a half times longer than wide. Prothorax slightly retracted before, its anterior margin bordered by a sharp projection, which forms on each side an indistinct angle. Mesothorax carrying on its posterior part four longitudinal furrows, and upon its anterior part one middle groove. Scutellum divided by a sinus. Metathorax offering a feeble concavity, wrinkled and striate. Petiole moderately short, its expansion globular, having almost the same form as in the *Z. cœruleipennis*, but less contracted behind and truncate; the second segment globular-ovate, but depressed.

Insect black, polished and shining. The metathorax garnished with a grayish pile. Clypeus, head, thorax, and petiole densely cribose with great punctures: this last carrying near its terminal border a large sunken place. Abdomen sown with finer punctures, sometimes very fine. There is often a slight depression toward the middle of the border of the second segment. A frontal dot at the insertion of each of the antennæ, the border of the prothorax or only two spots upon the shoulders, often a spot below the wing, a band or two spots upon the scutellum and the anterior border of the post-scutel, and also two spots at bottom of the metathorax, of a pale yellow. Margin of the petiole, and a narrow border along the margin of the second segment, of the same color. Feet black. Wings brown, with violet reflections.

♂. Smaller. Clypeus wide, moderately rounded, not having a lozenge shape, its inferior border straight, hardly bituberculate. This part either wholly or only in its inferior moiety, whitish. The scape of the antenna before, is ornamented with a whitish mark; the terminal hook black; on the face is often a little yellow dot at the side of the insertion of each of the antennæ. The third abdominal segment is often adorned with a whitish border. This is the *E. substricta* Hald. The female presents the same variations.

Var. a. Scutels, prothorax, and two great spots on the metathorax yellow (*Z. variegatus, bicolor*).

b. Often the scutels have hardly any spots, and the second segment is scarcely edged with pale yellow (*Z. substrictus*). Markings sometimes ferruginous.

c. Certain specimens are entirely black, with a little yellow

about the end of the petiole. These are the *Z. spinipes* Say (♀), and the *Eumenes pensylvanica* Hald. (♂).

d. Quite black; the clypeus margined with yellow (♂) (Missouri; Edw. Norton).

The punctures vary quite notably among this species. The head and the thorax are very coarsely cribrate; with the ♀, the clypeus is strongly rugose; the vertex often becomes shining from use. Among the ♀, the clypeus is less strongly cribrate. The second segment is sometimes hardly at all, sometimes quite strongly punctured. A specimen from Florida has the swelling of the petiole very coarsely cribrate.

Res. a. diff.—Easily recognizable by its size, which is superior to that of all the following species, and by its violet wings.

Hab. United States. Conn., Pa., Ill., Tenn., Ind., Fla. (14 ♀, 6 ♂).

Nota.—As I have already said (*loc. cit.*), the description given by Say is very defective, and calls for an interpretation. When this author says: "Peduncle rather slender," it is without comparison with the other species, the most of which he did not know. The "piceous dentate band of the margin of the peduncle" is but the subjacent double margins, which do not make it dentate except in the color. The "posterior margin abruptly and smoothly impressed of the 2d segment," alludes to the subjacent lamina on the border of the segment which are salient in almost all the insects of this genus, and which appear like a more distinct border than the veritable margin of the segment, which has the yellow band. By "tibiæ spinous behind;" the author means without doubt the posterior *extremity* (which offers a very short border) armed with stylets common to all the *Vespidæ*. (From this the name *spinipes*.) Finally, the author says that the second segment "has a distinct neck at base," which signifies a very short neck, for if it had been long, the word distinct was out of place. This species is not then a *Didymogastra*, but really a *true Zethus* (or *Zethusculus*), which makes us think, that it really is, without any doubt, the present species

19. *Z. spinosus* Savss. (Fig. 2, 2a.)—Parvulus, niger; capite, thorace et petiolo grosse peroribratis; clypeo integro, ♀ nigro-sericeo, ♂ flavo; fronte carina transversa et linea flava; pronoti margine cristatissimo postscutelloque spinoso fascia flava; petiolo cylindrico, rugoso,

flavo-marginato; segmentis tenuiter flavo-limbatis; secundo sericeo, nitido, punctato; alis subhyalinis.

Zethus spinosus SAUSS. Revue Zool. IX, 1857, 270.

Total length, 13 mm.; wing, 9 mm.

♀. Small, excessively rugose. Head large, dilated and convex, densely cribose with great pits; face carrying a transverse ridge, which covers the insertion of the antennæ. Clypeus almost transverse, convex, punctured, but much less rugose than the head; covered with a pile of dull gray silky hair; its inferior border entire; the middle of this border a little arched. Thorax all cribose with large sunken pits resembling a sieve. Its anterior border carrying a transverse rim in the form of a quite prominent lamina, which prolongs itself a little at the sides, descending along the margin of the prothorax. Post-scutel armed in the middle with a spiniform sharp and raised tooth, or rather, with a spine. The concavity on the posterior truncated face of the metathorax is divided by a furrow. The metathorax is very angulate; its lateral ridges very sharp; its posterior concavity very distinct, striate, bordered by two parallel longitudinal ridges, beyond which the metathorax is again quite rugose. Petiole as rugose as the thorax; its base alone smooth; its expansion lengthened, cylindrical, but little contracted behind, and cribose with very large confluent punctures. Second segment globular-ovate, a little pediculate, its pedicle hardly equaling a sixth the length of the segment. This segment is polished, shining and sericeous, although punctured, and appearing as wide as long when examined from above.

Insect black, with a transverse line on the face, a little dot behind each eye, margin of prothorax, post-scutel, two pyriform lines on the metathorax and a line on the border of segments 1, 2, 3, yellow. Sometimes also all the segments are bordered by a yellow or ferruginous band, and the last segments now and then ferruginous. Legs black; tarsi and tibiæ garnished with silky ferruginous hair; anterior knees spotted with yellow; intermediate tibiæ with a yellow line; the femora with a spot at end. Wing scales black, terminated behind by a yellow point by the side of which is a little yellow process. Wings sub-smoky, with brown nervures; the 2d cubital cell triangular, quite contracted anteriorly.

♂. Clypeus transverse quadrate, either wholly pale-yellow, or only its lower part; inferior margin entire and arcuate; the last two articles of the antennæ tawny beneath.

Var. a. Two yellow spots on the scutellum.

b. The yellow mark of the frontal ridge and that on the post-scutel, interrupted; the face presenting but two yellow points. The border of the prothorax is sometimes sprinkled with black dots.

c. The yellow markings hardly visible. Prothorax black. Legs black; wings a little smoky, with some ferruginous tints and the nervures brown.

d. The spine of post scutel yellow or black.

e. In small specimens, principally ♂, the spine is obliterated, or replaced by a little longitudinal carina.

f. The peduncle of the 2d segment rather longer; the spine of post-scutel obliterate.

g. The extreme edge of the clypeus ♂ black, or partly black, which causes very fallacious appearances.

Res. a. diff.—This species is very distinct, by its ridges, prominences, and rugosities, by the very large punctures of its petiole, and especially by the long spine of its post-scutel.

Hab. The gulf side of Mexico, in the warm parts. Tamaulipas, Huasteca, etc. Very common in Tampico. I have taken a score of specimens in view of the town of Pueblo-Viejo, against posts exposed to the sun. Various specimens also from Orizaba.

Fig. 2. The insect seen in profile, enlarged. 2, *b.* Its natural size. Fig. 2, *a.* The abdomen more enlarged.

20. *Z. imitator* n. sp.—Niger, crasse, dense punctatus: metanotus minus crasse punctato; petiolo ovato-cylindrico, crassissime cribrato; punctis 2 clypei; 2 frontis, pronoti margine, macula subalari, tegularum limbo, scutelli fascia interrupta, post-scutelli fascia, maculis 2 metanoti, abdominis segmentorum 10-30 limbo anguste, tibiisque intermediis basi extus, flavis. ♀.

Total length, 12½ mm.; wing, 9 mm.

♀. Form and sculpture about the same as in *spinosus*. Head small. Clypeus much rougher, very coarsely and confluent punctured, not broad, but rounded, more prolonged and truncate. A carina between the antennæ, prolonged on the clypeus. The rest of the punctuations about the same, very rough. Prothorax

a little more elongate; its angles very prominent; the post-scutellum quite destitute of a spine. Metathorax triangular, not carinated and not so rough. Petiole a little less cylindrical, a little more swollen, coarsely cribrate; the beginning of the swelling punctate like the rest, not polished (as if smelted) as in *spinosus*; 2d segment less globular, more pyriform, only punctate along its margin.

The ornaments more numerous than in *spinosus*, having a spot on each side of the clypeus, two on the face, the scape beneath, the border of prothorax, a macula under the wing, edges of the tegulæ, an interrupted fascia on the scutel and on the post-scutel, two maculæ on the metathorax, margin of petiole and a submarginal line on the edge of the 2d and 3d segments, yellow. The rest of the abdomen brownish; an abbreviated yellow fascia on the intermediate tibiz. Wings hyaline, a little brownish along the anterior margin; the 2d cubital cell *not anteriorly contracted*, having a distinct radial border.

Res. a. diff.—This species slightly resembles *Montezumæ* but is very distinct by the rest of its coloration, by its swollen, not depressed, and more coarsely cribose petiole; and by the second, more globular, less elongate segment of the abdomen.

It differs from *aztecus* and *Westwoodi* by its more sessile 2d segment, its more coarsely cribose and more cylindrical petiole, its maculated metathorax, without excavation, only parted by a sulcosity; smaller head, rough clypeus, etc.

It is nevertheless an embarrassing species, intermediate between *spinosus* and *Montezumæ*.

Hab. Mexico; the Oriental Cordillera (Mr. Sumichrast).

21. *Z. clypearis* n. sp.—Niger, crassissime dense cribrato-punctatus; pronoto acute angulato; metanoto 4-carinato, post-scutelli angulis dentiformibus; petiolo ovato tumido; punctis 2 frontalibus, pronoti margine, punctis 2 scutelli et 2 post-scutelli margineque petioli, flavis; margine 2ⁱ et 3ⁱⁱ segmenti sinuato, linea præmarginali flava; alis fumosis. ♂.

Total length, 13 mm.; wing, 9 mm.

Form and punctures as in *Z. spinosus*. The head very little wider than the thorax; the thorax short, crested in front, very square anteriorly; its angles sharp, a sort of crest bordering the sides of pronotum up to the wing-scale. Scutel rather salient;

post-scutel truncate, somewhat emarginate; its angles seen from before, elevated as two triangular teeth. Head and thorax quite densely cribose with very coarse confluent punctures; the scutel divided by a flat line. Metathorax coarsely but not so deeply cribose, short; its lateral edges very sharp; the posterior face having two *strong vertical carinæ*, starting from the angles of the post-scutel, but not going down to the extremity; the channel between them punctate; the sides of thorax as cribose as the dorsum, those of the metathorax not quite so rough. Petiole quite coarsely cribose, rather bidentate, with the anterior side polished, impunctate (as if smelted) as in *aztecus*, but the swelling not cylindrical (as in *aztecus*) but oval, thick, and truncate as in *otomitus*. The 2d segment subsessile (its form being a half sphere), and punctured; its second lamellar edge wide, getting wider on the sides. The first border of the 3d segment advanced in the middle; the 2d lamellar border sinuate, advanced in the middle, and emarginate on each side; getting wider outside of the emargination. The other segments very delicately punctate.

Black; the pilosity brown; that of the abdomen long and fulvous on the 2d and 3d segment. A line on the anterior margin of the mandibles, two spots over the antennæ, anterior border of prothorax; two dots on the angles of scutel, two on the post-scutel, posterior border of petiole, and submarginal border of 2d and 3d segments, yellow. The posterior margin of prothorax and the margin of the tegulæ, brown; the second border of 2d and 3d segment piceous. Knees and tarsi brownish; a yellow macula at end of the 1st femora; a yellow line on the 1st and 2d tibiæ outside; this sometimes tawny. Wings clouded with brown, with yellowish reflection.

♂. Clypeus rather rounded, black, very coarsely cribose, its inferior margin with three indentations in the middle, two little carinæ terminating in the external teeth; its surface very convex, having a very prominent transverse swelling, somewhat like a very obtuse carina; a yellow triangle with the angle turned downwards extends from that swelling to the end, and terminates in the middle indentation of the inferior margin. Antennæ rather thickened, terminated by a short biarticulate ferruginous obtuse hook.

Revs. a. diff.—This very remarkable species comes quite near to *Z. spinosus*, from which it differs by its bidentate, not spined

post-scutel and by its square, angled, not contracted prothorax; by its metathorax and petiole, etc. The very coarse punctation and very particular details of form of all the parts of the body distinguish this species from all the other Mexican *Zethus*, except from *Olmecus* with which it must be compared.

Hab. Mexico. The Oriental Cordillera, Orizaba.

22. *Z. Aztecus* SAUSS. (Fig. 1, 1a.)—Niger, rugose punctatus; pronoto antice valde cristato; fronte transversum in lineam elevato, flavo-bipunctato; petiolo ovato-inflato, crasse punctato; secundo segmento subpetiolato, fulvo-sericeo; pronoti margine, macula subalari, scutelli maculis 2, post-scutelli fascia abdominisque segmentorum 1-3 limbo, flavis; alis subhyalinis.

Zethus aztecus SAUSS. *Revue Zool.* IX, 1857, 270.

Total length, 15 mm.; wing, 10 mm.

♀. Head, thorax and petiole cribose with coarse crowded punctures, but less rough than with *Z. cristatus* and *Z. spinosus*. Clypeus polished, cribose with more distant oblique punctures, and hardly notched on its inferior border; the emargination divided by a little middle tooth; a little wavy transverse carina on the vertex, forming a sort of extension upon the insertion of the antennæ. Clypeus and orbicles rather silvery. Prothorax bordered by a vertical lamina in form of a crest, but which does not prolong itself upon the sides. Metathorax furrowed, with the concavity bordered above and furnished with a pile of gray hairs, having a slight tawny reflection. Post-scutel unarmed. Swelling of the petiole neither cylindrical nor globular, but oval, and, as seen in profile, dilated above. Second segment ovate-globular, not enlarging itself as suddenly as in the *Z. cristatus*; but it has no more length of pedicle, and the same silky, golden reflection.

Insect black; two dots on the forehead, border of prothorax, a spot under the wing, two on the scutel, the post-scutel, and the border of segments 1, 2, 3 orange-yellow. Wing-scales often touched with yellow. These colors offer the same variation as in the species cited; the crest of the vertex being often adorned with a yellow line, while the metathorax has no spots of this color.¹

¹ At least in my specimens. It will not do, however, to accept this as a constant character.

Feet black; tarsi rather ferruginous. Wings transparent, clouded, yellowish-brown, with the nervures brown—their reflection golden-gray.

♂. Anterior border of the clypeus notched as in the female; the angles of the indenture in the form of teeth, the middle tooth smaller than the lateral. All the clypeus covered with a silvery down; its lower moiety of a yellow color, as well as a line upon the scape of the antennæ. Mandibles yellow in front, the end of the antennæ black, the hook elongate, edged, and sharp; the terminal joints sometimes a little rolled up.

Res. a. diff.—It is a little smaller than *Z. Westwoodi*, and is distinguished from it by its more swelled and more coarsely punctured petiole, by its more indented, more strongly punctured clypeus, etc. It has the form of *Z. spinosus*, but it has no post-scutellar spine, etc.; and although rather coarsely punctured, that is really less so than this species.

Hab. Mexico, on the gulf side. Tampico.

Fig. 1. The male enlarged. Fig. 1, a. The head of the male seen from before.

Observation.—The figure 1 is not entirely satisfactory: the head not sufficiently thick, and the second abdominal segment with the pedicle a little too long.

23. *Z. Otomitius* n. sp.—Niger, dense punctatus; capite et thorace cinereo-, abdomine fulvo-hirto; antennis nigris, scapo linea flava; punctis 2 frontilibus, pronoti margine, fascia post-scutelli, abdominisque segmentorum 1-3 linea marginali, flavis; petiolo ovato-tumido nitido, punctato, apice truncato, superne impressione transversali; genibus et tarsis fuscescentibus; alis fusco-aureo nebulosis.—♂ clypeo trapezino, fascia submarginali flava.

Total length, 14 mm.; wing, 10 mm.

♂. Quite the same form and punctuation as *Z. aztecus*. But the clypeus not square, more triangular, wide inferiorly, narrowed at the summit, or rather in the form of a half circle, a little convex, densely punctured; the inferior margin wide and transverse; with a wide transverse emargination and two little teeth. A pale yellow band occupies the inferior part, but the extreme margin is black. The flagellum of the antennæ quite black; only the hook is sometimes brown beneath. The lateral carinæ of the metathorax a little more pronounced; the petiole not so coarsely punctate, a little wider behind, more truncate, somewhat as in

spinipes; the 2d segment without any impression before its border; scutell black; no macula under the wing. The intermediate femora have no yellow fasciæ. The wings are washed with brown, with a golden reflection; the 2d cubital cell generally triangular; its radial side wanting or quite short.

Clypeus and head gray-silky; abdomen golden-silky as in *Z. aztecus*.

Hab. Mexico; the Oriental Cordillera. Orizaba. (6 ♂ sent by Mr. Sumichrast.)

It is not without hesitation that I separate this species from *Z. aztecus*; but the clypeus is decidedly of a different form, and the coloration is quite the same in my six specimens, seeming to indicate a decided species. The end of the antennæ is quite black as in *Aztecus*.

24. *Z. chrysopterus* SAUSS.—Niger, ferrugineo-hirtus, staturæ *Z. Westwoodi*; capite latiore quam longiore, dense-punctato. Thorax valde punctatus, reticulato-rugosus; pronoti margine cristato, angulis prominentibus; scutello sulco partito; metanoto lævi, hirsuto, postice foveola distincta, carinis longitudinalibus 2 marginata instructo. Petiolus ovato-cylindricus, inflatus, parte lineari basali brevissima; secundum segmentum globoso-dilatatum, vix pedunculatum, fulvo-velutinum. Puncta 2 frontis et pronoti angulorum abdominisque segmentorum limbus anguste flava; tarsi ferruginei; alæ subferruginæ, tegulis piecis vel flavo-marginatis. Longit. 0.017.

♂. Clypeo punctato, dimidio inferiore aurantiaco, margine tenuiter nigro, bidentato.

Zethus chrysopterus SAUSS. *Vespides*, I, 13, 8, pl. viii, fig. 7, ♂, 1852; *Revue Zool.* X, 1858, 66.

Hab. Probably from South America. (Typus in auctoris musco.)

25. *Z. ferrugineus* SAUSS.

Zethus ferrugineus SAUSS. *Vespides*, I, 14, 10, 1852.

Hab. South America. Para.

26. *Z. cinerescens* SAUSS. ♀.—Niger, cinereo-sericeus; clypeo plano, punctato-striato, bidentato; capite dense punctato; thorace cribrato, striato-rugoso, antice cristato, angulato; post-scutello truncato; metanoto postice producto, rugoso, lateraliter cristato-carinato; in medio foveolato sed haud bicarinato; petiolo brevi, globoso-clavato, haud cribrato; abdom. secundo segmento subsessili, sed piriforme-dilatato (haud globoso), sericeo.—Puncta 2 frontis, pronoti margo, post-scutellum

et petioli limbus frequenter flava; tarsi fasci; alæ infuscatæ, secundum costam nigræ, tegulis ferrugineo-marginatis. Longitudo, 0.015.

Zethus cinerascens SAUSS. Vespides, III, 117, 3, 1854.

Hab. Brazil. (2 ♀ in museo auctoris; typus in museo Taurinense.)

Z. fraterno affinis, at differt pronoto cristato et angulato, thorace rugoso, petiolo minus punctato et globosiore.

The male is not known; some doubt still exists about the place this species must occupy.

27. *Z. biglumis* SPIN.

Zethus biglumis SPINOLA, Ann. Soc. Ent. Fr. X, 1841, 135, 83.—SAUSS. Vespides, I, 19, 20.

Hab. Cayenne.

28. *Z. discalioides* SAUSS.—Niger, capite et thorace valde cribrato-punctatis, punctis confluentibus rugosis; clypeo rugoso, oribrato, subbidentato; pronoto cristato-marginato, biangulato; scutello sulco partito; metanoto supra foveola striata instructo, cujus margines laterales fere cariniformes sunt; abdominis primo segmento brevi, ovato-campanulato, inflato, truncato, valde punctato; secundo segmento piformi, sericeo.—Tegulæ ferruginæ; frons et post-scutellum flavo-bipunctata; petiolus flavo limbatus; pedes fusciscentes; alæ paulum infuscatæ, aureo-nitentes. ♀.—Longit. 0.013.

Zethus discalioides SAUSS. Vespides, I, 17,¹ 17, 1852.

Hab. South America. Para.

Species moderately stout—viewing its short form and strongly inflated petiole—and resembling to some extent *Z. cinerascens*, though its 2d abdominal segment is less pyriform and the clypeus more strongly punctured and not distinctly striate.

This species, in view of its petiole, campanulate and truncate rather than contracted behind, might almost be placed in section β. (This form shows itself also among the *Z. spinipes*.)

β. Species which have more the appearance of *Eumenes* or *Discalius*. Head less inflated, less hollowed out at the occiput; thorax of moderate length; petiole more as in the *Eumenes* f. Division α.

¹ Last line of this page (of Vespides), instead of *Zethus*, read *Discalius*.

29. *Z. Montezuma* SAUSS. (Fig. 3, 3a.)—Parvulus, rugosus, niger et pilosus; abdomine ovato ut in genere *Eumene*; petiolo elongato perrugoso; reliqua parte abdominis piriformi, depressa; pronoti, post-scutelli et abdominis segmentorum 1, 2, margine, flavo vel ferrugineo; scapo, macula subalari et scutelli, margineque clypei, flavis.

Zethus Montezuma SAUSS. Revue Zool. IX, 1857, 270.

Z. Guatemotzin SAUSS. ibid. (var. ♀).

♀. Total length, 13 mm.; wing, 10 mm.

♂. Total length, 10 mm.; wing, 8 mm.

♀. Insect small, slender; head but little inflated. Ocelli in a regular or even lengthened triangle. All the head rugose, cribose with coarse punctures; clypeus entire, also cribose, convex and rugose. Thorax lengthened, one and a half times longer than wide, cribose with large punctures, rugose; on the disk of the mesothorax two arcuate grooves leave the scutellum, and extend to the anterior suture. Angles of the prothorax spinose; its margin relatively little prominent. Metathorax attenuated, convex, rugose, but with a lateral, very distinct truncation. Petiole quite lengthened, its anterior third, at least, linear; the remainder enlarged, pyriform, much lengthened and truncate, rugose, cribose with very large punctures (larger than those of the thorax); its enlargement but little raised, hardly contracted behind, its marginal depressions forming a transverse groove. The remainder of the abdomen depressed, regularly pyriform, lengthened as in the *Eumenes*, at the base sub-pedicate, gradually swelling; the second segment shining, polished, silky-gray, delicately punctured, more coarsely along its border.

Insect black, very hairy, even its abdomen being covered with a pile of erect hair in fresh specimens; hair of the head and thorax obscure; that of the metathorax and of the abdomen gray. Inferior and lateral border of the clypeus often ferruginous; a line under the scape of the antennæ, two dots at their insertion, margin of the prothorax, a point under each wing, two at the scutellum, two on post-scutel, and the border of the first two abdominal segments yellow or ferruginous. These markings are variable, the scutellum being often black and the post-scutel yellow; or the markings are entirely wanting. Wing-scales brown or ferruginous. Wings hyaline, nervures brown, and often a brown cloud in the radial cell.

♂. Smaller. Clypeus transverse, black, covered with silky-

gray hair; its inferior margin carrying in the middle a very small notch, above which is a little yellow. Antennæ a little tawny at the extremity, terminated by a hook and by a slight rolling up. Metathorax spotted with yellow; anterior border of prothorax often black.

Var. a. Clypeus and scutellum black; no spot under the wing.

b. At bottom of metathorax two yellow spots.

c. A yellow line in front of the mandibles.

Res. a. diff.—This species is recognizable by the particular form of its abdomen. The lengthened petiole, longitudinally linear, becomes suddenly campanular; the second segment gradually swelled, so that the abdomen is pyriform rather than globular-ovate. The lengthening of the thorax and the head a little enlarged, recall the forms of the *Eumenes*.¹ The metathorax, also, presents no concavity; the position of the furrow is, however, indicated, and it is rugose and striate, but is convex in place of being excavated.

This insect appears to be allied to *Z. discælioides*.

Hab. The temperate regions of Mexico. I have taken it in the valleys of Cordova, of Orizaba, and of Mexitlan (four females, five males).

I possess one specimen, a ♀, as small as the ♂, and which is a little more strongly punctured, which has the petiole shorter in the linear part, and is sensibly more coarsely punctured in its enlarged part. The scutellum and post-scutellum each have two yellow spots. Length, 0.010; wings, 0.008.

Is this a variety of *Z. Montezuma*, or a species? I have taken it on the banks of the Rio Panuco, in the Huasteca.

Fig. 3. *Zethus Montezuma*, ♀, enlarged. Fig. 3, a. The head ♀ seen from before.

30. *Z. parvulus* SAUSS.—♀. Parvulus, gracilis, niger; clypeo convexo, apice truncato, late submarginato; pronoto cristato-marginato, utrinque angulato; post-scutello carina arcuata antrosum convexa instructo, metanoto anguloso, supra carinulis 2 sinuatis e post-scutelli angulis emergentibus et postice convergentibus, instructo; petiolo gracili, in medio campanulato, punctato; secundo segmento paulum infundibuliformi.—Caput et thorax dense punctata, argenteo-sericea; antennarum articulis 1-3 subtus, genibus, tibiis et tarsis, ferrugineis;

¹ And slightly also those of the genus *Elimus*.

petioli margo flavo-notatus; alæ secundum venas infuscatæ. Longit, 0.011.

Zethus parvulus SAUSS. Vespides, III, 119, 5, pl. ii, fig. 1, ♀,¹ 1854.

Hab. Brazil. South of the Province of Goyaz. (Collected by the savant botanist Auguste de St. Hilaire.)

This species approaches to the form of *Z. Montezuma*; but it is much less coarsely punctured, smaller, and very clearly recognizable by the arcuate ridge of the post-scutel, which in continuation of the carinæ of the metathorax, forms a prominent horseshoe.

γ. *Petiole quite linear, filiform, depressed, very much elongate, as in Eumenes of Division ζ. The appearance of a Calligaster.*

81. *Z. strigosus* n. sp.—Niger, fulvo-sericeus, parum flavo-ornatum; pro- et mesonoto valde oblique strigatis; metanoto rugoso; petiolo lineari; 2o segmento basi breviter pedunculato; pedibus nigris, flavescens pilosis; alis subhyalinis.

♀. Total length, 14 mm.; wing, 11 mm.

♂. Total length, 12 mm.; wing, 8½ mm.

♀. Slender. Head strigate-punctured. Prothorax sharply margined, angular on each side, but not spined, obliquely strigose. The whole disk of mesothorax strongly obliquely strigose and wrinkled; the striæ converging against the middle carina. Scutellum shining punctate, a little sulcate in middle, as the post-scutellum. Metathorax rugose, velutinous, wrinkled on each side, at base parted by a channel; the lateral canthi carinated on the sides. Petiole very long and slender, not globulously swollen, but quite linear (as in *Eumenes* of Division Zeta) flattened, shining, and parted by an impressed line, punctate on the sides. Collar of the 2d segment distinct; the hinder margin of this segment very slightly reflexed.

Black, furnished with a yellowish-silky, or rather golden pubescence; the metathorax and pleura with cinereous pubescence. A line on the base of the inner margin of mandible, a line on the scape, two dots on the front, a very narrow line on both margins of prothorax, the post-tegulae, angles of post-scutellum, and two

¹ The male of this species is not known. It is possible that it should be placed in *section d*.

fasciæ on metathorax yellow. Scales margined with brown; a narrow yellow submarginal line bordering all the segments of the abdomen; the 6th segment yellow. Feet black, knees a little fulvous; tibiæ furnished with silky-golden hairs. Intermediate tibiæ with a yellow line. Wings subhyaline, with brown veins. On each side of the clypeus is a very dull, obsolete, yellow macula.

♀. Clypeus rounded, a little truncate at tip, punctured, rugose, black.

♂. Clypeus broad-quadrate, strongly punctured, slightly truncate in the middle of its inferior margin, with two hardly sensible edges; black; the lateral yellow spots often distinct. Antennæ rather thick; the whole terminal hook and the last three joints of the flagellum beneath, yellowish.

Var. ♂.—a. Clypeus yellow, with the top part and extreme margin black; sometimes also with two black dots on the yellow.

b. Clypeus more or less margined with yellow.

Var. ♂ ♀.—a. The spots of the forehead wanting.

b. The posterior margin of the prothorax not margined with yellow.

c. The anterior margin having only the angles yellow, or also a little line in the middle.

d. Prothorax black.

Hab. The Gulf side of Mexico. Orizaba. (Sumichrast.)

This species, although very variable in its coloring, is very distinct by its filiform pedicule and by the strong strigæ of its dorsum. It has the *facies* of an *Elimus*.

C. *Species which I do not know, and of which the antennæ ♂, have not been described.*¹

32. *Z. albopictus* SMITH.—♀. Niger, sat tenuiter punctatus; cinereo sericeus; antennis subtus apice ferruginescentibus; clypeo utrinque flavo-notato; pronoti margine, macula subalari, punctis 2 in tegulis, scutelli margine interrupto, punctis 2 post-scutelli tibiisque extus, albidis; abd. segmentorum 1-3 limbo et lineola (utrinque?) in basi secundi, albidis; alis pellucidis, secundum costam fuscis. Longit, 4½ lin.

¹ As the form of the abdomen has not been described, I presume that it offers nothing remarkable, and that in consequence all these species pertain to the division *Zethusculus*.

Zethus albopictus SMITH, Cat. Brit. Mus. Vespidae, 1857, 15, 32.

Hab. St. Domingo.

33. *Z. gracilis* SMITH.—Niger, capite et thorace grosse punctatis; fronte sulco transverso inter antennas et carina verticali ad medium clypeum producta instructo; metanoto in lateribus striato; petiolo sparse punctato; abdomine sericeo; punctis 2 frontalibus abdominisque segmentorum limbo anguste, flavis. ♂ antennarum scapo antice flavo. Longit, $4\frac{1}{2}$ lin.—Affinis videtur, *Z. Montezumæ*.

Zethus gracilis SMITH, Cat. Brit. Mus. Vespidae, 1857, 17, 43.

Hab. Mexico.

Small species, of the size of *Z. Montezumæ*.

34. *Z. laevinodus* SMITH.—♀. Niger, capite grosse, vertice sparse, punctato; clypeo rugose striato, apice subemarginato; thorace polito, punctis distantibus aliquot; pronoti margine acute marginato, acute angulato; mesonoto antice carina abbreviata, et sulcis 2 e scutelli angulis emergentibus ad pronotum ductis; metanoto velutino, bi-convexo. Thorax maculis 2 in pronoti angulis, macula-subalari, post-scutellique fascia interrupta, flavis; abdomine polito; alis fusco-eyaneis. Longit, 9 lin.

Zethus laevinodus SMITH, Cat. Brit. Mus. Vespidae, 1857, 17, 44.

Hab. Mexico.

By the fuscous wings this species comes near to *Z. spinipes*, but is separated from it by its distinctly polished mesothorax, and by its remarkably large size.

35. *Z. pallidus* SMITH, Cat. Brit. Mus. Vespidae, 1857, 11, 10.

Hab. Brazil. (Num *Zethusculus*?)

36. *Z. sculpturalis* SMITH, ibid. 11, 11, ♂

Hab. Brazil.

37. *Z. dubius* SMITH, ibid. 13, 19, ♀ ♂.

Hab. Brazil.

38. *Z. carinatus* SMITH, ibid. 13, 20, ♂.

Hab. Brazil.

Division DIDYMOGASTRA PERTY.

(SAUSS. *Vespides*, I, 18; III, 120.)

Second segment of the abdomen lengthened pediculate; its pedicular part forming at least a fourth of the length of the segment. The other characters as in *Zethusculus*.

These insects have very slender forms on account of the extraordinary length of their abdomen, by the double articulation of which, they enjoy the singular faculty of folding the abdomen beneath the thorax, and of placing the terminal pear against the face of the head.

The *Didymogastra* inhabit the hot regions of America.

One cannot establish any line of demarcation between the *Zethusculus* and the *Didymogastra*; these last form the continuation of the same genera and only represent the more lengthened modification of the type. The two series, based on the form of the antennæ of the males, continue themselves in the *Didymogastra*. So this division is wholly empirical, and should not be preserved except to facilitate the determination of species.

A. Antennæ of the males terminated by a rolled spiral.

39. Z. Poeyi SAUSS. (Fig. 4, 4a.)—Niger, rugose punctatus, metanoto vix striato, velutino; petiolo polito, tenuiter punctato, gibboso; secundo abd. segmento lævi, nitido, pedunculo mediocriter elongato; mandibulis, frontis fascia, orbitis bis interruptis, pronoto antice, maculis 2 subalaribus, tegulis, scutello et post-scutello antice, maculis 2 metanoti, petioli apice pedibusque, aurantiacis; his rufo vel nigro variis; abdomine ultra petiolum rufo; alis flavescentibus, apice grisescentibus.

♂. Fronte carinato; clypeo aurantiaco, emarginato, bidentato; mandibulis flavis; antennarum articulis 1–2 rufis, fascia flava; flagello subtus flavo-annulato, apice cochleato, flavo.

Zethus Poeyi SAUSS. *Revue et Mag. de Zool.* 1857, 270.

Total length, 14 mm.; wing, 10 mm.

Head and thorax quite densely cribose (moderate and a little irregular often, in form of an oblique prick of pin). Ocelli prominent, arranged in a rather large triangle. Vertex ♂ forming a ridge in form of a T, of which the vertical limb touches the clypeus. The posterior part of the vertex a little more elevated than the ocelli. Thorax contracted before, its margin little

salient. Scutellum punctured with coarse points, and divided by a groove. Metathorax punctured on each side of its summit, neither punctured nor striate on its posterior face, but velvety. Enlargement of the petiole convex; its swelling, seen in profile, is more salient near its base, and is depressed and contracted behind; on its extremity is an excavation. This enlargement, seemingly smooth and polished, is quite finely punctured. Second segment very shining and polished, its pedicle equalling a third of its length and widening posteriorly; the globular bell, as long as wide, enlarging gradually. Seen in profile, it is much more swelled above than beneath.

Insect black, with orange markings, which are in general arranged as follows: sinus of the eyes, the transverse bar of the frontal T, a point on the summit of each eye and the orbit behind the eyes; the prothorax, wholly or in part, a spot under the wing, wing-scale, the anterior portion of the scutellum and of the post-scutel, two spots on the metathorax and the extremity of the petiole, orange. These markings are more or less developed; they may be more extended, or in part wanting. The remainder of the abdomen is of a beautiful red or ferruginous, with the base of the pedicle black. Scape of the antennæ ferruginous. Feet yellow, varied with ferruginous. Wings ferruginous, with the end lightly gray, carrying a little reflection of violet.

♀. Clypeus rounded, black, with two oblique yellow bands at the superior margin; 2d joint of the antennæ ferruginous; a whole band of yellow under the wing; the margin of the 2d abd. segment narrowly yellow.

♂. End of the antennæ rolled spirally. Clypeus orange, finely punctured; its inferior border armed with two separated teeth, with an arcuate border between them, in the middle of which is a little salient tooth, often hardly visible. The first two and the last two articles of the antennæ orange; the flagellum annulate with this color beneath; the terminal spiral orange; the last article obscure.

Var. The specimens of other localities possess, without doubt, more of black on the abdomen and antennæ.

Rees. a. diff.—This *Didymogastra* is easily distinguished from *Z. Chicotencall*, by the rugose aspect of its head and thorax, by its much less striate metathorax, by its petiole more swelled

above, distinctly punctured; by its second segment with its less extended pedicle, and by the yellow markings of all the body.

It differs from *Z. Matzicatzin*, in its smaller size, in its much more lengthened thorax, having a mesothoracic disk longer than wide; in its metathorax, devoid of middle carinæ and of smooth spaces at the superior angles; in its scutellum, simple, depressed, angular (not emarginate) posteriorly; in its less enlarged and more punctured petiole, and in its head smaller, without swelling of the vertex.

The ♂ differs in its clypeus, quadrate, large, convex and notched as in the *Z. Poeyi*, not flattened and advanced in the middle as with the *Matzicatzin*; by the antennæ terminating in a spiral, by the ocelli placed upon a scarcely oblique plane, etc.

Hab. The island of Cuba. This beautiful insect was given me by Prof. F. Poey.

Observation.—In the figure, the thorax is too large and the form of the abdomen is not perfectly natural.

40. *Z. Romandinus* SAUSS.—Niger, cinereo-sericens, capite lato, dense punctato; thorace grossæ cribrato, antice cristato-marginato; scutello convexo, sulco, bipartito; metanoto convexo, haud foveolato, velutino, tenuiter punctato, supra utrinque spatii nitido lævi; petiolo dense punctato, nitido, postice paulum attenuato, flavo-marginato; secundo segmento sat breviter pedunculato tanquam in *Didymogastra*, piriformiter dilatato, marginem versus tenuiter punctato, tenuissime flavo seu ferrugineo-limbato; reliquis punctatis, piceo-limbatis; tegulis ferrugineo marginatis, pedibus, fusciscentibus; tibiis intermediis flavo-variis; alis diaphanis, subfusciscentibus.

♀. Clypeo transversim quadrato, flavo, tenuiter bidentato; antennis subtus apicem versus flavo-annulatis et apice cochlea fulva.

Longitudo, 14 mm.; alæ, 10 mm.

Zethus Romandinus SAUSS. *Vespides* I, 20, 22, pl. ix, fig. 1, ♀, 1852. *Revue de Zool.* X, 1858, 164.

Hab. Cayenne. (Typus in auctoris musæo.)

This *Zethus* constructs with woody fibres and gummy materials several rounded cells, with thick walls toward the bottom and irregularly united, recalling a little those of *Bombus* (see Sauss. *Vespides*, I, pl. ix, fig. 1, c). The instincts of these insects appear to progress toward the habits of the Social Wasps.

41. *Z. aurulentus* SAUSS.

Zethus aurulens SAUSS. Vespides, III, 121, 8, pl. vi, fig. 5, ♀, 1854.

Hab. Brazil.

42. *Z. Matzicatzin* SAUSS.—Niger; capite discoidali, lato, facie cribrata, vertice supra inflato, minus cribrato; ocellis in *declivitate frontis* sitis; thorace grosse cribrato, postscutello truncato, postice exciso, carinato; metanoto sulco conspicuo, at foveola nulla; infra valde striato, supra lævi, in medio bicarinato; petiolo polito impunctato, valde inflato, apice puncto maximo impresso; secundo segmento longe pedunculato, medio margine impresso, cum reliquis rufo; tertio punctato, in medio producto; punctis frontalibus et post-ocularibus 2, pronoti margine, macula subalari et maculis 2 scutelli, limboque segmentorum 1, 2, flavis; tibiis rufis; alis fusco-flavescentibus.

♂. Scutello plano, tenuiter punctato, infra macula lævi et margine in medio subproducto; antennarum scapo subtus flavo.

Zethus Matzicatzin SAUSS. Revue et Mag. de Zool. 1857, 271.

Total length, 18 mm.; wing, 11 mm.

Mandibles obliquely truncate, trenchant, without teeth, but with a single lobe. Head very large, much wider than thorax; face flattened; ocelli arranged in a broad triangle and placed, not on the summit, but on the slope of the vertex. Vertex strongly enlarged transversely behind the ocelli, but swelled upward. Face offering between the antennæ two little vertical carinæ. Thorax very short, quadrate, depressed; the margin of the prothorax little prominent. Disk of the mesothorax wider than long; its anterior curve describing a semicircle, not an ellipse as in all the preceding species. Scutellum divided by a channel. Post-scutel truncate, angulate; its posterior border offering a concavity and carrying an arcuated ridge interrupted in the middle (which especially distinguishes it from the preceding species, which has the post-scutel whole rounded above). Metathorax very angulate, having four sharp ridges, so to speak: 1st, the two ordinary lateral ones, which here form two sharp crests; 2d, two other very short ones, which start from the angles of the post-scutel; the middle divided by a strong channel, but, properly speaking, without any concavity. The summit of the metathorax, especially the space situated on each side between the two ridges, is smooth, shining, not punctured (or very finely striated), the remainder wrinkled. The flanks under the lateral ridges smooth

and shining. Petiole quite lengthened-pediculate; its elliptical enlargement is globularly swelled above, as high as wide (sub-compressed), having on its posterior extremity above, a large excavation, and on each side a large transverse groove, which compresses the end of the petiole, but without coalescing with the middle groove. Second segment lengthened-pediculate, almost as in the *Z. Chicotencatl*; its globular part very flat beneath, and much swelled above from its base; its first posterior border a little sinuous, preceded in the middle by a vague depression—its second border not being at all reflected. Margin of the third segment formed in the same way, but the first border more sinuous. Head coarsely punctured; the face cribose, but the vertical inflation very much less. Thorax cribose with sunken points, except the metathorax. Petiole and abdomen smooth and shining, while the last is very finely punctured. The third segment punctured.

Insect black, garnished with a gray or slightly golden pile; two spots on the face, one behind each eye; margin of the prothorax, a point under the wing, two spots on the scutellum, and the borders of the 1st and 2d segments, yellow. The abdomen, except the petiole, of a brown purple or ferruginous. Feet black, varied with ferruginous. Wings washed with brown-yellowish, nervures brown; wing scales bordered with brown or yellow.

♂. Clypeus very flat, punctured; its inferior margin advanced in the middle, entire; a smooth lozenge or triangle in the middle of its inferior extremity; this piece is black, covered with gray hair—its lozenge-shaped part smooth, often yellow. Antennæ black, with front of the scape yellow and terminated by a little ferruginous hook.

Res. a. diff.—See the affinities of *Z. Chicotencatl* and *Poeyi*.

The *Z. niger* offers also two metathoracic carinæ starting from the angles of the post-scutel; but in this species the post-scutel is not crenulated, and there is between these carinæ a concave pit, while here the two moieties of the metathorax remain convex and are separated by a deep furrow. The thorax and the head are also smaller, etc.

Hab. The gulf side of Mexico. Tampico. I have taken but one specimen (♂).

By the very remarkable form of its clypeus and its mandibles,

this species deserves to be noted as fit to serve as the type of one section of this genus.

B. Antennæ of ♂ terminated by a hook.

43. *Z. Hilarianus* SAUSS.—Gracilis, niger; capite dense punctato, supra et pone oculos tumefacto; thorace minus dense punctato; pronoto valde cristato-marginato, sed angulis haud acutis; mesonoti disco carinis 2 lævibus trajecto; post-scutello medio subdentato; metanoto velutino, rugoso, striato, in medio canaliculato; abdominis petioli tumefactione ovata, sat globoso-inflata punctulata; secundo segmento globoso, sericeo, basi sat longe petiolato (petiolus tertiam partem longitudinis efficiens); segmentis reliquis punctatis. Corpus omnino velutinum, argenteo-sericeum; puncta frontalia 2, maculæ 2 post-oculares, antennarum articuli 1-3 et apex, thorax, petioli latera et pedes, rufa; petioli apex et lineola utrinque in secundi segmenti petiolo, flava; segmentorum limbus tenuiter piceus vel rufus. Alæ infuscatæ, costa nigra. Longit. 0.016 mm.

♀. Clypeo convexo, punctato, apice late subexciso, tridentulato; maculis 2 lateralibus rufis.

♂. Clypeo truncato, rufo vel flavescente macula media et basi nigris, vel nigro margine infero rufo et laterali flavo; antennis apice ultimo minuto rufo.

Var. Color variabilis, plus minusve rufescens vel nigrescens; disco mesonoti obscuro vel nigro, carinis rufis; etc.

Zethus Hilarianus SAUSS. *Vespides*, III, 120, 7, pl. vi, fig. 6, ♀, 1854.

Varies in having the margin of pronotum and the post-scutel yellow, and in the distribution of colors, the reddish and black passing one to the other; but, nevertheless, a distinct species by its mesothoracical carinæ.

Hab. Brazil. Middle of the province of Goyaz. (The type is in the Paris museum.)—Venezuela, Caracas.

44. *Z. geniculatus* SPIN.

Didymogastra geniculata SPIN. *Mem. Acad. Turin*, XIII, 1853, 80, 60.

Zethus geniculatus SAUSS. *Vespides*, I, 22; III, 120, 6.

Metanoto postice bicarinato; colore affinis *Z. nigro*.

Hab. Brazil. Para. (Typus in mus. Taurinense.)

45. *Z. dicomboda* SPIN.—Niger, gracilis, dense punctatus, cinereo-sericeus; pronoto antice cristato-marginato, angulato; mesonoti disco bicarinato; metanoto convexo, velutino, haud rugoso, in medio striato.

Abdomen gracile, petiolo elongato, parum inflato, punctato, apice puncto impresso nullo; secundo segmento sat longe pedunculato, ovato-dilatato, depresso et tenuiter punctato.—Puncta 2 frontis, pronoti et tegularum margo, post-scutellum, fasciæ 2 metanoti et abd. segmentorum 1-2 margo, nec non fascia utrinque petioli secundi segmenti (vel petioli apicis) albida; femora intermedia subtus albido varia; alæ hyalinæ, venis ferrugineis, apice griseo-nebulosæ. Longit, 0.015 mm.

♀. Clypeo nigro, rugoso, truncato, sub-bidentato (vel sub-tridentato).

♂. Clypeo albido, supra nigro, margine infero bidentato, tenuissime nigro limbato; antennis nigris, uncinatis.

Epipona dicomboda SPINOLA! Gay's Historia física de Chile (Fauna Chilena), VI, 1851, 250.

Zethus discomboda SAUSS. Vespides, I, 21, 25.

Hab. Chili. (Typi in museo Parisiense et in auctoris servantur.)

C. Species of which the section remains undetermined.

46. Z. Chicotencatl SAUSS. (Fig. 5, 5a.)—Niger, politus, fulvo hirtus, clypeo convexo, capite dense punctulato, thorace lævigato, in medio disco nitido, impunctato; pronoto antice et pone angulos in lateribus cristato-marginato; metanoto hand excavato, ubique rugose striato, petiolo parum inflato, impunctato, nitidissimo, secundo segmento longe pedunculato, sericeo, secundum marginem punctato, margine subjacente reflexo; antennis subtus flavis; punctis 2 frontalibus, maculis 2 metanoti, et abdom. segmentorum limbo (aliquandoque pronoti), tibiisque supra, flavis; alis ferruginescentibus. ♀.

Zethus Chicotencatl SAUSS. Revue et Mag. de Zool. 1857, 271.

Total length, 17 mm.; wing, 12 mm.

♀. Mandibles strongly tridentate. Clypeus rounded, very convex, but finely punctured, truncate or sub-bilobed on its inferior border, in the middle of which is a smooth space. Head densely punctured, but not rugose. Ocelli salient, placed in a regular triangle on the vertex, the head a little contracted behind. Thorax shining and polished, *not being punctured* above the middle; margin of prothorax forming a salient lamina; this margin reflexes upon its angles and prolongs itself behind, along the lateral border of the prothorax over a moiety of the distance from the wing scale. Mesothorax punctured along the scutellum, without groove on its hinder part, but carrying a double longitudinal groove on its anterior moiety; scutellum convex and shining, feebly punctured. Metathorax a little flattened behind,

having a very small groove, strongly striated transversely or rather channelled in all its superior and posterior surface (situated above the lateral ridges). Some striæ, but less distinct, also cover entirely the lateral faces of the metathorax, beneath the angles. Enlargement of the petiole in an oval form, much lengthened, depressed, without any globular swelling above; its linear portion short, equal to a third the length of the petiole, smooth, shining, without punctures. The posterior depression not having an excavated point, but a transverse shining channel. Second segment much lengthened, pediculate; its pedicle forming almost the moiety of the length of the segment, which offers a zone of fine punctures along its posterior border; the second lamina of this margin a little reflected. The whole insect is covered with a tawny pile almost woolly on the thorax, gray on the metathorax, a little golden on the abdomen, but the body is polished and shining, especially the petiole, which does not show any punctures.

Color black; antennæ ferruginous beneath, obscure above. Two dots on the face, two spots on the metathorax and often the post-scutel and the margin of the prothorax, yellow or tawny. Petiole having a yellow interrupted border; the abdominal segments wholly or in part margined with a very narrow yellow line. Feet black. Tibiæ yellow before. Wings transparent, washed with yellowish-gray.

Res. a. diff.—This species appears to me very near to *Z. tubulifer*. It may even be identical; which I dare not say positively, not having the type of this last before my eyes, and being without a sufficient description.

It is very recognizable by its back as well as its petiole, being without punctures and shining. The *Z. Chicotencall* is not difficult to distinguish from the *Z. Matzicatzin*, by its metathorax, rugose even to the summit and without middle carinæ, by its post-scutel, which is not notched behind, by its much less enlarged petiole, by the border of its second segment, which is punctured, and by the second lamina of its border, which is turned up; perhaps also by its thorax, which is not cribose, and by the ocelli, which occupy the summit of the vertex.

Hab. The gulf shore of Mexico. I have taken it at Tampico. (The *Z. tubulifer* comes from Orizaba in the Cordilleras.)

Observation.—In the figure the petiole is not quite suddenly enough enlarged, and the profile of the pedicle of the second segment is a little too short, as also in the linear part of the petiole.

47. *Z. tubulifer* SAUSS. Vespides, I, 18, 19, ♀.—Niger: clypeo rotundato; antennarum scapo subtus ferrugineo-notato; pronoto angulato; punctis 2 frontalibus, pronoti margine, tegulis partim, maculis 2 scutelli, fascia interrupta post-scutelli, maculis 2 metanoti, margine lineolaque laterali utrinque petioli apicis, segmentorum margine punctisque coxarum, flavis; pedibus flavo-variis; alis fumosis. Longit, 0.017–18.

Hab. Mexico. Oriental Cordillera.

48. *Z. Zendalus* n. sp.—Niger, punctulatus, capite et thorace griseo-sericante; metanoto tenuissime strigato; pronoti fascia, macula subalari, maculis 2 scutelli, 2 metanoti, petioli apicis lineolis 2 lateralibus, et lineolis 2 lateralibus 2ⁱ segmenti basis, citrinis; segmentis reliquis late rufo-marginatis; ano rufo. ♀

♀. Total length, 14 mm.; wing, 10–11 mm.

Head and thorax densely and delicately punctured. A little compressed brilliant point between the antennæ. Prothorax margined, but not angulated. Metathorax velutinous, very delicately strigate, divided by a channel. Petiole ovate, narrow, very delicately punctured like the abdomen, destitute of an impression at the end. Peduncle of the 2d segment rather long.

Black, with grayish hair; the margin of prothorax, a spot under the wing, two on the scutellum, two elongate maculæ on the metathorax, and a sinuous lateral line on each side of the extremity of the petiole, a line on each side of the peduncle of the 2d segment, and two dots at its base, lemon-yellow; a broad fascia on the margin of segments 2d–5th, and the 6th segment, orange-yellow or rufous. The apex of the petiole has no yellow margin and no groove, but the base of the peduncle of the second segment has two yellow dots, which can be easily taken by error for a yellow marking of the apex of the petiole. Feet black. Wings smoky with a golden reflection, the nerves black.

♀. Clypeus rounded, densely punctate, black like the antennæ and mandibles.

Res. a. diff.—Distinct from *Matzivatzin* by its moderate head, absence of impression at the end of petiole, and absence of

having a very small groove, strongly striated transversely or rather channelled in all its superior and posterior surface (situated above the lateral ridges). Some striæ, but less distinct, also cover entirely the lateral faces of the metathorax, beneath the angles. Enlargement of the petiole in an oval form, much lengthened, depressed, without any globular swelling above; its linear portion short, equal to a third the length of the petiole, smooth, shining, without punctures. The posterior depression not having an excavated point, but a transverse shining channel. Second segment much lengthened, pediculate; its pedicle forming almost the moiety of the length of the segment, which offers a zone of fine punctures along its posterior border; the second lamina of this margin a little reflected. The whole insect is covered with a tawny pile almost woolly on the thorax, gray on the metathorax, a little golden on the abdomen, but the body is polished and shining, especially the petiole, which does not show any punctures.

Color black; antennæ ferruginous beneath, obscure above. Two dots on the face, two spots on the metathorax and often the post-scutel and the margin of the prothorax, yellow or tawny. Petiole having a yellow interrupted border; the abdominal segments wholly or in part margined with a very narrow yellow line. Feet black. Tibiæ yellow before. Wings transparent, washed with yellowish-gray.

Res. a. diff.—This species appears to me very near to *Z. tubulifer*. It may even be identical; which I dare not say positively, not having the type of this last before my eyes, and being without a sufficient description.

It is very recognizable by its back as well as its petiole, being without punctures and shining. The *Z. Chicotencall* is not difficult to distinguish from the *Z. Matzicatzin*, by its metathorax, rugose even to the summit and without middle carinæ, by its post-scutel, which is not notched behind, by its much less enlarged petiole, by the border of its second segment, which is punctured, and by the second lamina of its border, which is turned up; perhaps also by its thorax, which is not cribose, and by the ocelli, which occupy the summit of the vertex.

Hab. The gulf shore of Mexico. I have taken it at Tampico. (The *Z. tubulifer* comes from Orizaba in the Cordilleras.)

Observation.—In the figure the petiole is not quite suddenly enough enlarged, and the profile of the pedicle of the second segment is a little too short, as also in the linear part of the petiole.

47. *Z. tubulifer* SAUSS. Vespides, I, 18, 19, ♀.—Niger: clypeo rotundato; antennarum scapo subtus ferrugineo-notato; pronoto angulato; punctis 2 frontalibus, pronoti margine, tegulis partim, maculis 2 scutelli, fascia interrupta post-scutelli, maculis 2 metanoti, margine lineolaque laterali utrinque petioli apicis, segmentorum margine punctisque coxarum, flavis; pedibus flavo-variis; alis fumosis. Longit, 0.017–18.

Hab. Mexico. Oriental Cordillera.

48. *Z. Zendalus* n. sp.—Niger, punctulatus, capite et thorace griseo-sericante; metanoto tenuissime strigato; pronoti fascia, macula subalari, maculis 2 scutelli, 2 metanoti, petioli apicis lineolis 2 lateraliibus, et lineolis 2 lateraliibus 2ⁱ segmenti basis, citrinis; segmentis reliquis late rufo-marginatis; ano rufo. ♀

♀. Total length, 14 mm.; wing, 10–11 mm.

Head and thorax densely and delicately punctured. A little compressed brilliant point between the antennæ. Prothorax margined, but not angulated. Metathorax velutinous, very delicately strigate, divided by a channel. Petiole ovate, narrow, very delicately punctured like the abdomen, destitute of an impression at the end. Peduncle of the 2d segment rather long.

Black, with grayish hair; the margin of prothorax, a spot under the wing, two on the scutell, two elongate maculæ on the metathorax, and a sinuous lateral line on each side of the extremity of the petiole, a line on each side of the peduncle of the 2d segment, and two dots at its base, lemon-yellow; a broad fascia on the margin of segments 2d–5th, and the 6th segment, orange-yellow or rufous. The apex of the petiole has no yellow margin and no groove, but the base of the peduncle of the second segments has two yellow dots, which can be easily taken by error for a yellow marking of the apex of the petiole. Feet black. Wings smoky with a golden reflection, the nerves black.

♀. Clypeus rounded, densely punctate, black like the antennæ and mandibles.

Res. a. diff.—Distinct from *Matzicatzin* by its moderate head, absence of impression at the end of petiole, and absence of

carinæ on the middle part of the metathorax. Differs from *Chicotencall* by its prothorax not crested on the sides, its petiole narrower, etc. It comes very near to *Romandinus*, but the thorax is shorter anteriorly, more narrowed posteriorly; the petiole narrower, less inflated, etc.

Hab. Mexico. The Oriental Cordillera (Mr. Sumichrast).

49. *Z. miscogaster* SAUSS.—♀. Minutus, niger, dense punctatus, cinereo hirtus; clypeo integro, rugoso, piloso; fronte inter antennis transversim carinato; ocellis in summo fronte sitis. Thorax antice cristatus, carinatus, humeris haud spinosis; postscutello et metanoto haud rugosis, velutinis, hoc tenuiter striato, nec carinato, nec distincte foveolato, sed sulco profundo diviso. Abdomen politum, sericeum; petiolo elongato, parum inflato, supra parum gibboso; secundo segmento longe pedunculato, ovato-dilato subdepresso. Caput immaculatum; pronoti margo, macula subalaris, maculae scutelli et 2 metanoti, lineola utrinque, petioli apex, limbus secundi segmenti, lineolaque utrinque in basi pedunculi, flava. Alæ subpellucidæ, venis fuscis.—Longit. 0.015.

Z. discombode similis at minor, et pronoto haud anguloso differt. A *Z. Romandino* differt staturâ graciliore, petiolo minus punctato et minus tumefacto.

Zethus miscogaster SAUSS. Vespides, I, 18, 18, ♀, 1852.

Zethus microgaster (per errorem) SAUSS. Revue Zool. X, 1858, 163.

Hab. South America. (Typus in auctoris museo.)

50. *Z. binodis* FABR.—Gracilis, niger, dense punctatus. Caput latum, dense cribratum; clypeo rugose cribrato, integro. Thorax cribratus, cristato-marginatus, clypeo convexo, nitido, cribrato; postscutello hand cribrato, postice truncato, sed cantho acuto nullo; metanoto in medio foveolato, carinis prominentibus duabus e postscutelli angulis emergentibus; apatio extra carinam sito utrinque valde striato-plicato; usque ad canthum lateralem acutum. Abdominis petiolo polito, tenuiter punctato, sat ovato-tumefacto, apice utrinque flavo-notato; secundo segmento globoso, longe pedunculato, ubique tenuiter punctato, sericeo setoso, in medio margine impresso; tertio, in medio margine paulum producto; 2^o et 3^o tenuissime flavo-marginatis; reliquis piceis vel ferrugineis. Tibiæ 1, 2, ferrugineæ. Alæ subhyalinæ. Longit. 0.017.

Vespa binodis FABR. Ent. Syst. Suppl. 1798, 264.—COQUEB. Illust. Icon.

Ins. pl. xv, fig. 2.

Eumenes binodis FABR. S. P. 287.

Zethus binodis SAUSS. Vespides, I, 20, 23.¹

¹ Typus in museo Parisiensi.

Zethus niger SAUSS.¹ Vespides, I, 1852, 21, 24, pl. viii, fig. 9.²

A *Z. Rmundo* differt metanoto carinato, foveolato et plicato; petiolo globosiore et minus valde punctato; secundo abd. segmento globosiore, magis pedunculato, et punctatiore; segmentis 3-5 minus punctatis; tertii margine in medio producto.

Hab. Cayenne.

51. *Z. didymogaster* SPIN.

Zethus didymogaster SPIN. Ann. Soc. Ent. Fr., 1841, X, 133, ♀.

Hab. Cayenne.

This species differs from *Z. binodis* in its very wide clypeus, having a straight border, armed with two distant teeth. (Has not the author taken a male for a female? Only the males have the clypeus twice as wide as long.)

52. *Z. fuscus* PERTY.

Didymogaster fusca PERTY, Delect. Anim. Artic. 145, pl. XXVIII, fig. 5, ♀, 1830.

Zethus fuscus SAUSS. Vespides, I, 19, 21; III, 120.

Hab. Brazil. Amazon.

53. *Z. Smithii* SAUSS.

Zethus Smithii SAUSS. Vespides, III, 122, 9, ♀.

Metanoto striato; alis fusco-cyaneis.

Hab. South America.

SPECIES WHICH I DO NOT KNOW.

The following species of the genus *Zethus*, all from Brazil, have been described by Fred. Smith in the Catalogue of the Vespidae of the British museum, page 11-18.

Z. pallidus—sculpturalis—dubius.

Z. carinatus—albopictus—gracilis—lævinodus.

¹ Typus in auctoris museo.

² Errata. Fig. 8, pl. viii, Vespides, I, does not represent this species, but *Z. piriformis*.

Gen. **LABUS** SAUSS.

Labus SAUSS. Reise d. Oesterr. Fregat. Novara. Hym., p. 3.

Mandibles short, obliquely truncate, with 3-4 terminal teeth. *Maxillæ* elongate; their palpi elongate, 6-jointed. *Labium* elongate, quadrifid, its palpi 4-jointed. *Head* rounded, swelled at the occiput; clypeus rounded or truncate.

Thorax elongate; its anterior angles sharp.

Abdomen very slender; its petiole elongate, linear. *Wings* somewhat as in *Eumenes* and *Zethus*.

As the forms of the insects of this type are becoming various, one could well think that the genus *Labus* might be fused into *G. Elimus*, which only differs from this by another form of thorax and petiole. Such differences occur under the species of the genus *Zethus*.

- A. *Petiole* filiform at base, a little widened posteriorly; its extremity margined by a transverse rounded cordon preceded by a transverse channel (as in *Eumenes* of Division Omicron). *Second segment* sessile, elongate. *Metathorax* attenuated. *Head* inflated. *Second cubital cell* much prolonged at the basilar extremity; the second recurrent vein inserted after the middle of its posterior border. (*Asiatic type*.) *L. Spiniger* Sauss., *L. Humbertianus* Sauss.
- B. *Petiole* linear, slender, prismatic; 2d segment subpediculate. *Thorax* elongate; *metathorax* short; *prothorax* crested anteriorly. *Second cubital cell* equally dilated at both extremities; second recurrent vein inserted in the middle of its posterior border. (*American type*.)¹

¹ The genus *Elimus* would make a third type:—

- C. *Petiole* linear, rather thick (very elongate, somewhat pyriform), bidentate; its extremity marked with an impressed point; head moderate; thorax oval, not acute angled anteriorly; *metathorax* rounded; the 2d segment elongate, rather attenuate posteriorly; 2d cubital cell in a regular truncate triangle; second recurrent nerve inserted in the middle, or a little before the middle, of its posterior border.

1. *L. Sichelianus* n. sp. (Fig. 20, 14a.)—Niger, gracilis, thorace elongatiusculo, antice cristato-marginato, superne crassiuscule punctato; petiolo lineari-prismatico; 2^o segmento basi subpedunculato; capitis maculis, pronoti margine antico, maculis 2 scutelli et 2 metanoti abdominisque segmentorum marginibus, flavis.

Total length, 11 mm.; wing, 8 mm.

♀. Antennæ rather clubbed. Head quite orbicular, rather swelled and rounded at the occiput, densely punctured; a little carina between the antennæ. Mandibles short truncate, armed with three terminal teeth, tricarinate at end. Clypeus ovate, as wide as long, a little truncate at tip, covered with coarse punctures, substrigate. Ocelli disposed in an equilateral triangle. Thorax a little depressed, flattened above, rather ovate (that is, elongate), rounded posteriorly, a little contracted anteriorly, truncate and margined with a crest; the angles of prothorax salient. The thorax above strongly punctured, not so strongly on the sides; the metathorax a little shagreened; the lateral faces of this not punctured. Metathorax having its posterior face vertical, somewhat truncate, triangular, but quite arcuate at the summit, and margined by a little arcuate ridge, rough and obsolete; the hind face parted by a depression and a little strigate in the groove. Disk of mesothorax elongate, having two arcuate furrows. Petiole elongate, quite linear; only its base filiform; the rest depressed and compressed, making it prismatic, with a dorsal, two lateral faces and an inferior face; the faces having scattered punctures; the superior one not parted by a furrow, but with a round impression before the border; the inferior one carinated; the lateral faces having the margin a little salient because of their compression; the compression being more sensible behind the middle of petiole, so that the anterior part of the swelled portion is a little wider than the rest and a little ovate. The rest of the abdomen nearly impunctate; the second segment globular, but its base a little funnel-shaped and articulate by a very short neck as in the *Zethusculus*. Anterior tibiæ very short.

Black, with short gray pile. Antennæ a little ferruginous at the extremity beneath; a spot in the middle of the mandibles, a line on the scape, a spot on each side of clypeus, two dots over the insertion of the antennæ, and one in the sinus of each eye,

yellow. The anterior margin of prothorax, two marginal spots on each wing scale, post-tegulae, two spots on post-scutel, two longitudinal fasciae on the metathorax, the end of petiole and the margin of the abdominal segment, yellow; the lamellar margin of these also yellow or ferruginous, as well as the margin of the anus. A spot at the end of the femora and a line on the tibiae of the first two pair, yellow. Wings subhyaline with brown veins; the 2d cubital cell subtriangular; its radial tip very little truncate; the second recurrent nerve inserted in the middle of the posterior margin.

Ess. a. diff.—This remarkable type has a certain resemblance to the *Eumenes* of Division *Zeta*, because of its elongate linear flattened petiole; but this is not so much flattened, nor parted by a furrow, but prismatic, and the head with its short mandibles is quite that of a *Zethus*.

It has a very near relationship to the Asiatic *Labus* but differs essentially by its prismatic petiole, a form which I have not yet met with in the Wasp.

Hab. Chili. (This insect was given to me by the celebrated oculist and remarkable entomologist, Dr. Sichel, to whom it is dedicated.)

Gen. **DISCÆLIUS** LATR.

Lip moderate. Labial palpi composed of four articles. *Maxillary palpi* composed of six articles. *Mandibles* short, obliquely truncate. *Head* often enlarged and a little emarginate behind. *Thorax* lengthened, often angulate before. *Abdomen* pediculate; the first segment transformed into a campanular or linear petiole.

This genus differs from *Zethus* by its labial palpi composed of four articles, and from *Eumenes* by the mandibles which are not prolonged in the form of a beak.

This genus connects itself to *Zethus* by its mandibles, and to *Eumenes* and to *Odynerus* by its complete palpi; the forms of its representatives are also intermediate, in some degree, to *Zethus* and to *Eumenes*, and somewhat to *Nortonia* and *Zethus* by the subpediculate abdomen. The form of the thorax, often bordered and angulated before, especially assimilates it to that which one sees in the *Zethus*.

1. D. merula CURTIS.

Discalium merula CURTIS, Trans. Linn. Soc. XVII, 325, 1834.—SAUSS.
Vespides III, 124.

Epipona chilensis SPIN., Gay's Hist. fisica de chile, Zool. VI, 248, 1851.

Discalium chilensis SAUSS. Vespides, I, 25, 1, 1852.

Discalium Spinolæ,¹ SAUSS. Vespides, I, 25, 2, 1852, III, 124.

Hab. Chili.

2. D. pulchellus SAUSS.—♀. Parvulus, punctulatus; clypeo piri-formi; apice truncato; pronoto antice biangulato, metanoto rotundato; petiolo brevissimo, campanulato grosse punctato; apice puncto impresso; abdominis secundo segmento nitido, supra inflato.—Insectum nigrum, mandibulis puncto basali, clypei apice macula nigra, fascia frontali, puncto post-scutellari, scapi fascia antica, flavis; antennarum flagello subtus ferrugineo; pronoto antice, tegulis, scutellis et metanoto, flavis, (sed puncto in tegulis et metanoti sulco nigris;) abdominis segmentorum 1^a 2^a limbo et secundi maculis 2 lateralibus, flavis; pedibus flavis, fusco-variis; alis hyalinis, stigmatibus et areola radiali fuscis, costa fuscescente.

♂. Mandibulis et clypeo flavis; hoc apice subbidentato, antennarum uncino minuto ferrugineo.

Discalium pulchellus SAUSS. Vespides, III, 127, 15.

Hab. Mexico; Jamaica.

Legion II. **The Odynerites.**

Mandibles more or less lengthened, terminating in a point, forming generally by their union a long sharp beak, or when crossed, an X. Their teeth placed on their inner border (*Vide* Saussure, Vespides, I, p. 27, 11).

Gen. **EUMENES** FABR.

Organs buccate, very long. Tongue long, a little plumose. Galeas (or appendices) of the jaw very long. Palpi lengthened; labial composed of four articles; the maxillary of six. Mandibles very long, sharp pointed, having a triturating *lateral* border and forming by their union a lengthened beak. (In exceptions the mandibles are sometimes shorter.)

¹ A variety of *Chilensis*.

Head much compressed transversely, that is, wide, but not thick, nor enlarged; the eyes very convex and entirely covering the cheeks. *Clypeus* always longer than wide, with a variable termination (bidentate, indented, truncate, or rounded).

Thorax variable, globular, or long quadrate, rarely compressed, but always without spiniform angles.

Abdomen lengthened *pediculate*. The first segment forming a linear or subcampanulate petiole, about as long as the thorax; the remainder of the abdomen pyriform.

This genus is very abundant in species, and is found over all the surface of our globe. It is broken up into peculiar types, of which one (Division *Alpha*) is represented everywhere, and the others solely on one part of our planet. These types are connected by natural transitions which embarrass one in assigning them very fixed limits.

The *Eumenes* are well represented on the new continent. Of six divisions¹ into which I have divided the genus, four are found on the Western Continent, but the divisions *Pachymenes*, *Omicron*, and *Zeta*, are only represented in the tropical parts of America. The insects, peculiar to the Division *Omicron*, inhabit all the equinoctial parts of the continent; and those which belong in the Division *Alpha*, extend themselves over the two American continents within their most extended limits.

Division PACHYMENES.

(SAUSS. Vespides I, 73, III, 153.)

Abdomen much depressed, never compressed, petiole widened or campanular, parted by a groove; its hinder margin having usually a transverse groove; clypeus generally bidentate; body smooth, silky, and chatoyant or velvety; wings large. (American type.)

These insects have the appearance of *Polybia*, as the *Montezumia* have that of *Synæca*. It is especially by this appearance that one recognizes them and the semblance holds good in the depressed form of the petiole and in the pyriform abdomen as well as the silky appearance of the body.

¹ I do not count the Division *Pireumenes*, which is worthy to form a genus (Etudes sur la Famille des Vespides, III, 133).

Among certain species, the thorax becomes narrow, lengthened, compressed, and the metathorax is sometimes lengthened, so that the resemblance to the *Polybia* increases. Although the *Pachymenes* present a series of forms *corresponding* to those which one sees among the *Polybia*; yet one can easily distinguish them from these social insects by their truncate or bidentate clypeus, which is not angularly terminated by a sort of tooth.¹

This group is not as yet well studied; most of its species, which appear to be rather numerous, are only known by rare specimens scattered about in collections which have much similarity among themselves, all having a silky body and colors pale or variable, so that one can easily confound them.

Unfortunately it is impossible for me here to establish good differential characters between these insects, from only knowing some of them by unique specimens and not having under my eyes the types of all species heretofore described.

I established the genus *Pachymenes* in the monography of solitary wasps to receive those *Eumenes* of which the clypeus is bidentate, the abdomen depressed, and of which the smooth and satin-like body recalls the appearance of *Polybia*. But I have now renounced this section, so difficult to define, although including insects of a very peculiar appearance; for since that time I have found many American *Eumenes* having the clypeus bidentate at the end, while certain *Pachymenes* have a bidentate petiole, which destroys one of the differences on which the genus *Pachymenes* was founded. I have, therefore, undertaken to reduce the consideration of this generic group to that of a simple division of genera, and this division itself goes over into the division *Omicron* so that it is impossible to fix a refined limit between them. (Ex. *E. Santa-Anna* goes over to division *Omicron* and is quite close to *E. lævis*.)

1. Form rather lengthened; thorax longer than wide; abdomen hardly depressed, the 2d segment not campanular.

A. *Petiole campanular, enlarged above beyond the middle,*

¹ In my *Monographie des Guepes Solitaires*, I have confounded certain species of *Polybia* described by Fabricius with the *Pachymenes*. See *Vespides*, III, p. 153. (On the line before the last of that page, for *chrysothorax*, read *pallipes*.)

humped, the boss divided by a groove; its extremity bordered by a salient band.

a. Thorax rather compressed, lengthened.

- 1. *E. sericeus* SAUSS.**—*Gracilis, fusco-niger; thorace compresso; pedibus, petiolo et thorace supra ferrugineo-fulvis; hoc valde fulvo-velutino; alis subhyalinis, costa fusca. ♀.*

Pachymeres sericea SAUSS. *Vespides*, I, 74, 1 (Syn. excl.); pl. xii, fig. 5; III, 153.

Total length, 19 mill.; wing, 15 mill.

♀. Slender; thorax compressed, rather narrow anteriorly. Head black; clypeus bicarinate at the extremity, bidentate or notched; the inner orbits and a line behind the eyes rather yellowish. Antennæ at tip a little ferruginous beneath. Thorax blackish, but having its upper parts ferruginous or ornamented with yellowish, and all covered, as well as the sides, with velvety fulvous hair, rather woolly, which makes it quite fulvous. Petiole slender, ferruginous velvety; its base brown, its extremity a little obscure with a more yellowish border; the rest of the abdomen of a brown-olivaceous color. Feet ferruginous, more or less brownish or yellowish.

Res. a. diff.—Very much resembles *auratus*, from which it differs principally by its quite woolly, velvety hairy thorax and by its less bidentate clypeus.

Hab. Brazil. Bahia. (Paris museum.)

- 2. *E. auratus* n. sp.**—*Fulvo-olivaceus; capite fusco; clypeo bidentato, apice testaceo-marginato; thorace aureo-sericeo, compresso, metanoto valde angusto, sed pronoto antice haud coarctato, petiolo campanulato, gibboso, sulco subpartito, apice puncto impresso, basi nigro; mandibulis, orbitis, prunoti marginibus, mesonoti et metanoti fasciis 2, scutellis, tegulis et macula subalari, frequenter testaceis; alis paulum ferrugineis. ♀.*

Total length, 17 mill.; wing, 13 mill.

♀. Insect slender, of an olive-brown, rather velutinous. Head blackish, with the orbits somewhat bordered with testaceous; clypeus flattened, a little bicarinate, toward the end strongly bidentate; its teeth spiniform, separated by a triangular notch; its extremity and its inferior border yellow-testaceous, as well as the mandibles. Antennæ ferruginous beneath, especially toward

the end. Thorax convex, *strongly compressed*, strongly contracted toward metathorax, but not on the prothorax, which is squarely truncate. All the corselet covered with a silky golden-yellow pile; the posterior border of the prothorax and its anterior margin about the angles, two bands on the mesothorax, two on the metathorax, scutels, wing scales, and a spot under the wing testaceous. Abdomen olive-brown, silky, having an olivaceous reflection; petiole campanulate in the middle; its dilated part carrying a boss terminated by a groove, its border limited by a rim or rounded band. Its linear part black at the base and a little testaceous, second segment oval, lengthened, depressed. Legs varied with testaceous; wings transparent, ferruginous, with the extremity griseous.

Res. a. diff.—This species resembles the *E. olivaceus* in the form of its head and of its abdomen, but its thorax is more compressed, more narrow and lengthened in proportion; the metathorax is much compressed and is not bicarinate.

It may be that this is a variety of the *E. sericeus* of which the woolly hair of the thorax has been rubbed off?

Hab. Brazil. Bahia.

3. *E. chrysothorax* SAUSS.

Pachymenes chrysothorax SAUSS. Vespides, III, 153, 43.

Hab. Brazil. (Typus in museo Parisiensi.)

This species, of which I cannot again examine the type, is most likely a var. of *E. sericeus*. It is proper to notice that the forms should be those of *E. pallipes*.

b. Thorax not compressed, moderately wide.

4. *E. pallipes* SAUSS.—Fusco-olivaceus; capite nigro; antennis apice subtus ferrugineis; clypeo bicarinato, apice bispinoso, testaceo; orbitis partim, mesonoti fasciis 2, scutellis, metanoto superne pleurisque, flavo-testaceis; pedibus ferrugineis; alis ferrugineis, apice fusco-nebulosis; petiolo sat dilatato, superne tumido, ante marginem canaliculato. ♀. Longit. 17 mm.

Pachymenes pallipes SAUSS. Vespides, I, 75, 3 (Syn. excl.); III, 153.

This species is not so slender as the preceding; the petiole is wider. The insect is probably sericeous when living.

Var. Prothorax bordered with testaceous

The colors are certainly very variable.

Hab. South America. (Paris museum.)

5. *E. olivaceus* n. sp.—Olivaceo-fuscus, clypeo valde bidentato, apice flavo-testaceo; thorace aureo-sericeo, antice quadrato, metanoto superne bicarinato; petiolo tumido sulco partito; antennis subtus, tegulis et tarsis, ferrugineis; orbitalium maculis fascia interrupta post-scutelli tibiisque extus testaceis; alis diaphanis, ferrugineis. ♀.

Total length, 20 mill.; wing, 15 mill.

Brown-chocolate or olive. Head and antennæ blackish. Head and thorax very delicately punctured, sericeous; prothorax broad and square; metathorax narrower, short, having in its superior part two carinæ which start nearly from the angles of the post-scutel. The whole thorax with a golden reflection, velutinous principally on the metathorax. Petiole pyriform-campanular, swelled above, parted by a delicate groove, bordered by a cordon preceded by a transverse groove. The rest of the abdomen depressed—pear-shaped; the 2d segment rather elongate.

Antennæ ferruginous beneath, principally at the extremity; wing scales and tarsi ferruginous. Mandibles, a line behind each eye, and often the inner orbits testaceous. Tibiæ, knees, and coxæ varied with pale yellow; an interrupted line of this color margining the post-scutel. Borders of prothorax often ferruginous or with golden reflections. Wings transparent, ferruginous.

♀. Clypeus oval, black, scarcely punctate, ending with two carinæ in two long teeth, separated by a triangular notch; its extremity and inferior margins yellow-testaceous.

Ress. a. diff.—This species much resembles *E. obscurus* and *ater*, but differs by its metathoracic carinæ. It differs from *E. brunneus* by its scrolled, swelled, and bordered petiole.

Hab. Surinam. This species has been communicated to me by Capt. Von Heyden from the Senkenberg Museum at Frankfurt (Germany).

6. *E. obscurus* SMITH.—Validus, niger, sericeus; clypeo apice bidentato; mandibulis, flagello, pedibus anticis subtus, pronoti margine postico tegulisque, ferrugineis; alis hyalino-ferrugineis. ♀.

Pachymenes obscura SMITH, Cat. Brit. Mus. Vespid., 34, 7 (1857).

Total length, 22 mill.; wing, 18 mm.

♀. Black. Clypeus pyriform, having a triangular notch at its extremity, and bidentate; often two little carinæ terminating in the apical teeth. Mandibles long, slender, a little arcuated at

tip. Thorax rather square shaped anteriorly, not margined. Petiole campanulate, rather short; its dilatation broad, swollen superiorly; the longitudinal channel quite obsolete, only distinct on the anterior part of the dilatation. The rest of the abdomen depressed.

The whole body very smooth; head and thorax very finely punctured, covered with a fine fulvous silky pubescence. Mandibles, flagellum of the antennæ, fore legs beneath, posterior margin of the prothorax and wing scales, ferruginous; the borders of the abdominal segments often brownish or ferruginous. Wings transparent-ferruginous with brown nervures; their apical part griseous.

Var. a. Legs, knees, etc., rather ferruginous.

b. Abdomen quite black.

c. A little ferruginous spot under the wing; two dots on base of antennæ.

d. An interrupted ferruginous line on the post-scutel and two obsolete lines on the mesothorax.

e. Metathorax and scutels marked with ferruginous (*obscura* Smith).

f. The general color brownish.

g. The emargination of the clypeus more or less pronounced; the clypeus not bidentate, only a little emarginate at tip.

h. A yellow mark on each side of the clypeus.

Res. a. diff.—This species much resembles *E. ater*, but the thorax seems to be shorter and thicker. It differs from *Aztecus* by its shorter petiole, of which the dilation is more triangular, less elongate, and by its clypeus destitute of spines. Compare *E. ater*.

Hab. The temperate parts of Mexico. Orizaba. 6 ♀.

7. *E. ater* SAUSS.—Niger, obscure-sericeans; clypeo bidentato, sulfur-o-marginato; orbitis partim, post-scutelli fascia interrupta et petioli margine, sulfureis vel ferrugineis.—♂ tibiis flavo-variis.

Pachymenes atra SAUSS. *Vespidæ*, I, 75, 2; III, 153.

Total length, 20 mill.; wing, 15 mill.

Form nearly as in *E. obscurus*; clypeus bidentate in the same way; the same punctuation, but a little smaller in size. The metathorax clothed with gray pile. The petiole not quite so

much dilated posteriorly, having on its hinder part a very obsolete wide channel. The thorax shorter, more convex; the anterior margin a little bordered.

Black, with a fine sericeous reflection; flagellum of the antennæ beneath, principally at tip, ferruginous; an interrupted line on the post-scutel and on the hind margin of the petiole, yellow. The end of the femora and the tibiæ a little tinged with yellow. Wings ferruginous.

♀. The emargination and the lateral borders of the clypeus, a line along the orbits inside and at top outside, sulphur-yellow; mandibles in part and the tarsi, ferruginous.

Var. The mesopleuræ marked with ferruginous; the end of the clypeus not yellow. Margin of segments brownish.

♂. Antennæ terminated by a little brown hook. The yellow ornaments of clypeus more extended. Mandibles black; tibiæ with a yellow band.

Var. No yellow border at the petiole.

Res. a. diff.—This species differs from *Olivaceus* by its metathorax, which is not carinated.

Hab. Brazil. Rio Janeiro. 2 ♀, 2 ♂.

B. Petiole pyriform, depressed, less inflated above, not divided by a groove.

S. E. Santa-Anna. (Fig. 6, 6a.)—Niger, politus, vel punctulatus, argenteo-sericeus; clypeo bidentato; metanoto brevi, convexo, abdomine depresso; puncto frontali, pronoti margine postico, et antice fascia interrupta, scutelli margine, post-scutello, maculis subalaribus, et segmentorum abdominis 1, 2 limbo tibiarumque fascia, luteis; alis fusco-venosis.—Valde variabilis species.

Eumenes Santa-Anna SAUSS. *Revue. et Mag. de Zoolog.*, IX, 1857, 272.

Total length, 16 mill.; wing, 11 mm.

Of medium size. Body polished, nearly impunctate. Ocelli arranged on an arcuate line. Clypeus bidentate; its teeth spiniform. Thorax wide and quadrate before; very slightly bordered anteriorly; its angles a little rounded. Metathorax short, convex, as among the true *Eumenes*, polished and punctate. Abdomen much depressed. Petiole nearly of the length of the thorax, campanulate, smooth, and shining, its posterior moiety very wide and strongly depressed, its posterior border thickened

in a marginal cordon, which is preceded by a transverse groove; the convexity not divided by a longitudinal furrow. Second segment short above, nearly wider than long; its posterior border not turned up. The metathorax has its lateral faces plane and obliquely cut.

Insect black, little or not at all punctured, but smooth, shining, and garnished with a silky pile of gray hair, which gives it a satin-like or silvery appearance. A line on the scape, a little dot on the face, a line behind each eye, posterior border of prothorax along the curve of mesothorax, an interrupted border on the anterior margin of prothorax, two spots under the wings and a point on each side of the summit of the metathorax, anterior border of the scutellum, post-scutel, and border of segments 1, 2, of a sulphur-whitish color, generally a lateral yellow spot smelted with the border of the petiole. Antennæ black, ferruginous beneath. Legs black, the tibiæ marked with a yellow line. Wings transparent, with the nervures, the costa, and the radial cell brown. Wing scales red or brown; their appendicular scale yellow at the extremity.

♀. Clypeus margined with yellow on each side.

Var. Clypeus black; the scape only tawny beneath.

♂. Hook of the antennæ long and ferruginous. Clypeus black, argenteous.

Var. a. No spots on the metathorax. The spots of the thorax more or less complete. This part of the body often passing into brown. The flagellum ferruginous beneath.

Hab. The gulf side of Mexico. Tampico. Orizaba, Cordova. 5 ♀, 1 ♂.

2. Thorax short, globular. Petiole somewhat funnel-shaped, much lengthened; 2d segment almost the shape of a globular bell. Body velvety, bristling with hair.

9. *E. ventricosus* SAUSS.

Pachymenes ventricosa SAUSS. *Vespides*, I, 77, 5, pl. xii, fig. 7.

Var. a. Second abdominal segment not margined with yellow.

b. Wings very dark with brown reflections.

Hab. South America. Sante Fé de Bogota (not Carolina, as a false "étiquette" made in print). Venezuela.

•
Division OMICRON.

(SAUSS. Vespides, I, 71; III, 133, 148.)

Body sericeus. Clypeus ♀ bidentate, often bicarinate. Thorax very short, cubical before, globular behind. Petiole very elongate—pear-shaped, not campanulate in the middle, swollen into a polished boss at the extremity; its margin bordered by a polished cordon, preceded by a transverse channel or constriction, but without impressed point at the extremity; the marginal cordon forming a simple yellow (or black) line, without indentations as in Division α. The rest of the abdomen more or less depressed, never compressed, often polished. Second abd. segment having its colored border followed by a second lamellar margin; second cubital cell short. Antennæ of males with a very small terminal hook, or even quite destitute of hook, as in the females.

Ornaments.—The colored border of the posterior margin of prothorax more pronounced than the anterior one; fasciæ generally not wide. The petiole often ferruginous in the middle and on the sides, its hind margin with a yellow band, and often also ornamented on each side by an oblique yellow line fused with the yellow border.

This section only contains species of small size. The head and the thorax are very large compared with the abdomen; they are sometimes cribose with great punctures and covered with a silvery pile, in place of being hairy, sub-woolly as most species of the Division *Alpha*. The clypeus is more or less bidentate, never distinctly truncate, and the ocelli have a tendency to arrangement in a straight or arcuate transverse line. The emargination of the eyes is situated very low, almost in the middle of their height, and these organs entirely cover the sides of the head, which is short. The antennæ are inserted very low, sometimes below the middle of the head.

The thorax is drawn together so as to become at times wider than long. In front it holds in effect to the cube, being squarely cut; behind it is rounded, tending rather to the globular form. The part situated before the scutellum is always sensibly wider than long, and the prothorax is not in the least attenuated; on the contrary, it is angulate, squarely cut, and forms the wider part of the thorax. The *scutels* are quite driven back upon the slope of the metathorax, which is completely drawn together, having its

inferior part almost retracted before; its posterior face is convex, not at all or hardly divided by a channel into two ridges: its lateral faces are oblique, and form at their meeting with the hinder part two trenchant vertical edges. Behind the wing scale there is a little process. The petiole, at first slender, expands at the extremity more like a small funnel than in a pyriform shape.

The clypeus of the males is generally not colored yellow as in the division *Alpha*, but resembles that of the female.

The most perfect type of this little group is the *E. globicollis* Spin.

The characters which call for enumeration are on each side more and more effaced among the species which by their form approach to the type of Division *Pachymenes* and of the Division *Alpha*. (For example the *E. callimorpha* holds almost middle ground between the Division *Omicron* and *Alpha*; *E. Sumichrasti* has a sort of impression at the end of petiole, as in Division *Alpha*; *E. infernalis* has the second segment swelled, subcompressed, etc.)

One must not be too particular about the indefinable limits of the divisions.

A. *Thorax quite short, cubic-globular, larger than the pear of the abdomen; the 2d segment of this wider than long (as in genus Tatus), wide-globular.*

10. *E. globicollis* SPIN. ♀.—Niger, cano-sericeus, dense-cribrato-punctatus; capite latiore quam longiore; clypeo pentagonali, lævi, punctulato, apice subfisso; thorace globoso, pænelatiore quam longiore, superne valde convexo, antice truncato, vix perspicue marginato; petiolo antice lineari, postice trigonali, parum marginato; 2^o abd. segmento depresso, truncato, cum sequentibus valde cano-illudente; antennis subtus, macula frontali, pronoti marginibus, scutellis pedibusque, petiolo subtus, nec non abd. segmentorum margine, plus minus obscure fusco-ferruginescentibus; orbitis postice, post-tegulis, margineque petioli, flavis; alis basi fusciscentibus. Long. 9 mill.

Variat. fere omnino niger, vel 2^o abd. segmento flavo-limbato.

Zethus globicollis, SPINOLA Ann. Soc. Ent. Fr., 1841, X, 150, pl. xiii, fig. 6.

Eumenes globicollis SAUSS. Et. Vespides, III, 151, 40, pl. viii, fig. 6, Ga.

Hab. Brazil. Para. (Typus in museo Spinolæ (mus. Taurinense) et in auctoris musco.)

11. *E. regulus* SAUSS. (Fig. 7, 7a, 7b.)—Minutus, niger, subsericeus; thorace minore, sparse cribrato-punctato; abdomine polito; clypeo submarginato; antennis subtus et pronoti margine antico, ferrugineis; puncto frontali, margine postico pronoti, post-scutelli et abdominis segmentorum 1-2, flavis; alis infuscatis, stigmate opaco; tegulis ferrugineo-marginatis.

Eumenes regulus SAUSS. Rev. et Mag. de Zool., IX, 1857, 272.

Total length, $7\frac{1}{2}$ mill.; wing, 6 mill.

♀. Very small. Head densely punctured. Ocelli placed in a line very little bent, not forming a triangle. Clypeus delicately punctured, convex, having its extremity pointed, hardly notched and bidentate. Thorax strongly cubical, offering all the characters of the division, cribose with large deep scattered punctures; angles of the prothorax a little raised. Metathorax flattened convex, only divided by a line, cribose like the rest of thorax. Petiole as long as the thorax, polished, not cribose, linear as far as the middle, then enlarged triangularly, bossed, swelled above at the extremity and finally bordered with a salient yellow cordon, which is preceded by a transverse channel; the pyriform part of the abdomen very small. Second segment globularly bell-shaped, depressed, wider than long, flattened beneath, convex above, polished, offering a satin-gray reflection; its hinder border rather concave, cut out.

Insect black, clothed with a silvery pile: mandibles, the scape and extremity of the antennæ beneath and a point between their insertion, ferruginous; posterior border of the orbits and a point in their sinus, yellow or ferruginous; anterior border of the prothorax ferruginous; the posterior one margined with a yellow band, which makes an angle with a ferruginous or yellow fascia placed on the sides before the wing scale. Anterior margin of scutel, post-scutel, and a line on each side on the edge of the metathorax, or only a spot on each side on its summit, yellow; wing scale ferruginous or bordered with brown, the post-tegular process yellow. Often there is on the thorax something of brown. Petiole often having its middle and a line on each side ferruginous; its hinder margin adorned with a yellow border, fused with a yellow spot on each side of its extremity. The second segment margined with yellow. The other segments black, or bordered by a yellow or testaceous submarginal slightly sinuous band. Feet

black, varied with ferruginous; tarsi and tibiæ 1st, 2d, brown or ferruginous. Wings transparent, smoky; brown along the anterior margin; the brown extending as far as the end of the radial cell. Stigma very large, black, often opaque, surrounded by a transparent zone. First discoidal cell almost rectangular; third cubital wider than long; the second small.

♂. Thirteenth article of the antennæ very variable, sometimes rudimentary, not forming a hook, but only a little tubercle, sometimes forming a very small black hook; sometimes more elongate, ferruginous. Sometimes the antennæ are simple, as in the females. Clypeus as in the ♀, hardly emarginate, shining, black; its inferior extremity only presenting two small approaching projections, or a little parted by a channel; black, as in the ♀, or with two yellow dots near the summit.

Var. a. Markings of the thorax often ferruginous and the little process situated behind the wing scale, not yellow; the yellow fasciæ of the last segments of the abdomen dull, sometimes ferruginous.

b. Head entirely black. Scutel scarcely marked with yellow.

c. The scape of the antennæ ferruginous, obscure above.

d. Wing scale ferruginous.

e. Petiole quite black.

f. The yellow ornaments changing into ferruginous.

g. Metathorax quite black.

h. No yellow fascia before the tegulæ on the sides.

Common varieties.—*A.* The 2d segment a little shorter; its margin a little more concave. Hinder margin of prothorax honey-yellow or fulvous; scutel and post-scutel dull rufous, mesopleuræ dull rufous. (10 ♀, 2 ♂.)

Var. Scutel rufous, post-scutel yellow. I cannot consider this as a different species.

B. Prothorax quite black, with the hinder margin yellow; scutel black; post-tegulæ and post-scutel yellow; two yellow dots on top of metathorax, or two lines on its angles.

Res. a. diff.—Differs from the *E. microscopicus* (its near neighbor) by the arrangement of the ocelli, which do not form a triangle, but only an arcuate line.

It is distinguished from *E. Mexicanus* by its small size; by its yet shorter thorax, more analogous to that of the *E. globicollis*; by its abdomen, longer and smaller in proportion; by its clypeus

not distinctly bidentate at the end; by the opaque stigma of the wing; and by the much coarser puncture of the thorax. It differs from *E. aviculus* by its smaller thorax, polished, impunctate abdomen; from *thoracicus* by its smaller, regularly convex thorax; from *Totonacus* by its grayish-silky body, its pale yellow ornaments, its narrow abdominal bands, and its wings in which the 2d recurrent nerve is not interstitial, but falls into the 2d cubital cell. This *Eumenes* much resembles *Polybia occidentalis*, *parcula*, etc., but differs by its clypeus not angular and by the punctures of the body.

Hab. The hot and temperate regions of Mexico. Tampico, Cordova, Orizaba. (I have taken several specimens, ♀ ♂, at Tampico and at Cordova, 44 ♀; 27 ♂.)

Fig. 7 represents the male enlarged; the petiole is a little too short, and its pyriform part too large. In the fig. 7a, the clypeus is not sufficiently prolonged at the extremity, and too truncate. In the fig. 7b, the abdomen is too large.

12. *E. Totonacus* n. sp.—Minutus, niger, nitidissimus; thorace punctato, petiolo elongato, lineari, apice trigonaliter dilatato; pronoti margine postico, post-scutello, metanoti strigis 2, abdominis segmentorum 1ⁱ, 2ⁱ margine sat late, late flavis, petiolo medio ferrugineo; alis infumatis, 2^a vena recurrenente interstitiali.

♀. Total length, 8 mill.; wing, 6½ mill.

♂. Total length, 7 mill.; wing, 5½ mill.

♀. Quite similar to *E. regulus*; only differing by the following: Body more brilliant black, less grayish-silky. Clypeus shining, delicately punctured, and its extremity parted by a groove, subbidentate. Head finely punctured. Scutel convex, parted by a strong groove. Metathorax parted by a groove up to the top as in *Regulus*, or still more strongly; more polished, punctures more scattered. Petiole a little longer; all of the abdomen very much polished.

Black: A spot at base and extremity of the scape, and the extremity of antennæ beneath, tawny; a spot in the sinus of the eye and one behind the summit, yellow or tawny; posterior margin of prothorax, post-tegulae, post-scutel, and angles of metathorax, bright yellow; the middle of the petiole ferruginous; its margin yellow; on each side a transverse line fused with the yellow border; the second segment with a rather broad yellow

fascia; those following with a piceous border. Tibiæ and tarsi more or less ferruginous. Wings cloudy, the 2d recurrent nerve quite *interstitial*, or even falling a little into the third cubital cell.

♂. Hook of the antennæ very small.

Var. a. Metathorax without yellow fasciæ.

b. A spot under the wing and the anterior border of prothorax in part, yellow or tawny.

Res. a. diff.—This species is an example of the difficulty of the study of these numerous little Mexican species, which is not possible but with numerous specimens. It quite resembles *E. regulus*, but the body is very much polished (like glass), very black, not grayish, and the more elongate filiform part of the petiole gives it a peculiar appearance; the yellow ornaments also are bright yellow, not citron; the yellow fascia of the 2d segment is wider, and nearly double; the tip of petiole has a fascia; lastly the character of the wing is a very sure guide in distinguishing this species.

Hab. Mexico. Baños. 3 ♀, 1 ♂.

18. *E. aviculus* n. sp.—Parvulus, thorace valido, globoso, convexo, dense cribrato-punctato; abdomine punctato; petiolo postice trigonali obscure rufo-variegato, scutellis et pedibus partim rufis; alis nebulosis; variat scutello nigro, post-scutello flavo.

♀. Total length, 8-9 mill.; wing, 6.3 mill.

♂. Total length, 7.5 mill.; wing, 5 mill.

♀. Form much the same as in *E. regulus*. But the thorax much larger, cubic; the petiole wider, more triangular posteriorly, and more inflated. Head a little more strongly punctured, thorax more densely, quite densely cribose; the petiole and abdomen are also densely punctured, but not so coarsely as the thorax. Clypeus a little wider, cribose, its apex also subbidentate, or divided by a little groove. Disk of mesothorax more wide than long, parted anteriorly by a little sulcosity; scutels quite oblique, forming altogether with the metathorax the convex hind face of the thorax. Second segment depressed.

Black, very slightly sericeous. Tips of mandibles, antennæ beneath, a frontal spot, a line behind the eyes, borders of prothorax, mesopleuræ, tegulæ, scutels, sides of metathorax and of the abdomen, borders of all the segments, tibiæ, and tarsi, dull-

rufous. Wings cloudy, iridescent; nerves and stigma blackish; 2d cubital cell as in *E. regulus*, as long as wide; its radial margin broad.

Var. a. Mandibles more ferruginous. Antennæ dull ferruginous with an obscure line on the scape, and blackish on the flagellum.

b. Head black without ferruginous spots.

c. Prothorax ferruginous.

d. Post-scutel and tegulæ blackish.

e. Prothorax black, only the posterior border ferruginous.

f. Angles of post-scutel, post-tegulæ, and border of petiole yellow.

♂. Smaller. Clypeus grayish-silky. Antennæ with a little ferruginous hook. The frontal spot, scape beneath, margin of petiole yellow.

Var. Prothorax black; its hinder margin yellow; post-scutel yellow; margin of the abdominal segments yellowish.

Common variety.—Generally of small size. Body quite black; scape and apex of the antennæ beneath ferruginous. Posterior border of prothorax, post-scutel, border of abdominal segment, 1st, 2d, yellow; of the others dull-yellowish. Tegulæ fuscous; feet partly ferruginous. Petiole not so much dilated posteriorly, more pyriform than triangular. (5 ♀, 2 ♂. Cordova.)

Res. a. diff.—A very distinct species by its large convex thorax and *strongly punctured abdomen*. The head and thorax are much as in *Thoracicus*, but the dorsum of the thorax is regularly convex, not deformed. In the little varieties, the thorax gets smaller, and the petiole narrower than in *Regulus*, but the punctured abdomen always enables one to distinguish the species.

Hab. Mexico; the Oriental Cordillera; Orizaba, Cordoba, Moyoapam. (12 ♀, 6 ♂)

14. *E. thoracicus* n. sp.—Parvulus, niger fulvo-velutinus; thorace sat valido, globoso, superne deformi, mesonoti disco subbicarinato, utrinque foveolato et subgibberoso, sparse cribrato-punctato; abdomine impunctato, petiolo postice piriformi; corpore obscure rufo-variegato; scutellis rufis; petiolo flavo-limbato; alis nebulosis.

♀. Total length, 10 mill.; wing, 8 mm.

♂. Total length, 9 mill.; wing, 7 mm.

♀. Head and thorax as in *E. aviculus*. Clypeus punctured, but not bicarinate, and parted by a groove at tip; having the tip

flat, a little truncate, or sub-emarginate. The head a little more unequal; the grooves of the antennæ stronger, etc. The thorax not quite so large nor so cubic anteriorly; *the disk of the mesothorax* somewhat gibbous, having two longitudinal carinæ in the middle and on each side before a sort of sinking or excavation, behind which is an eminence next to the wing scale; two sulcosities continue the excavation up to the scutel; the scutellum oblique, parted by a groove; the metathorax still more divided by a groove. The thorax covered with strong, rather scattered punctures; on the metathorax not so strong. Abdomen polished, not punctured, or only indistinctly; petiole more elongate, not so broad, behind more pyriform-truncate than triangular, not much inflated.

Black, with a fulvo-sericeus pile. End of mandibles, antennæ beneath, a frontal spot, a line behind the eyes, and a spot in their emargination, dull ferruginous. Both borders of prothorax, tegulæ, post-tegulæ, scutels, and sides of the abdomen, obscure ferruginous; border of petiole with a yellow margin; the other segments with an obscure ferruginous marginal band; that of the third and following segments twice notched. Feet ferruginous, black at base. Wings cloudy, nerves blackish.

♂. A little smaller, but quite identical with the female. The clypeus might be a little more bidentate; the hook of antennæ small, blackish.

Var. a. Antennæ, prothorax, and mesopleuræ more or less ferruginous.

b. The disk of mesothorax not bicarinate.

Res. a. diff.—This species is very much like *E. aviculus*, having nearly the same coloration, but differs principally by its not strongly punctate abdomen, and narrower, longer petiole. It is easy to distinguish from all neighboring species by its deformed mesothorax; in other things quite close to *E. regulus*.

Hab. Mexico. Oriental Cordillera. (20 ♀, 3 ♂, Mr. Sumichrast.)

B. *Thorax a little longer than wide. The 2d segment of abdomen sometimes rather elongate.*

15. E. Mexicanus. (Fig. 8, 8a.)—Sat minutus, niger, dense punctatus; scutello crassius cribrato; clypeo plano, nitido, apice bispinoso; utrinque antennis subtus et pronoti margine antico, ferrugineis, puncto

frontali, pronoti margine postico et abd. segmentorum 1ⁱ, 2ⁱ limbo, flavis; pedibus obscure ferrugineis, basi nigris; alis subinfuscatis.

Eumenes Mexicanus SAUSS. Rev. Zool., 1857, VI, 272.

♀. Total length, 11 mill.; wing, 8 mm.

♂. Total length, 10 mill.; wing, 7 mm.

Not so small as the preceding; head wide, densely punctured. Clypeus pyriform, flattened, terminated by two sharp, spiniform teeth; a frontal carina between the antennæ continued by a delicate sulcosity up to the middle ocellus. Thorax cubical before, rounded behind, nearly as wide as long; densely punctured throughout; its anterior margin a little turned up.

The punctures a little finer on the metathorax, those of scutellum coarse and more distant or scattered. Disk of mesothorax parted by a delicate sulcosity. Abdomen shining and polished; petiole punctured but shining, at first linear and then truncate, pear-shaped, bossed, somewhat bidentate, rimmed at the extremity; the rim preceded by a strong constriction; the pyriform part of the abdomen shining and satin like; very finely punctured; the second segment a little contracted behind, slightly depressed; that is, wider than high, somewhat wider than long; truncated a little from above downward and from before backward; that is, the inferior face is a little longer than the superior; the posterior border slightly sinuous in the middle; the subjacent lamina not sinuous.

Body black, clothed with a silvery-fulvous pile. Mandibles ferruginous at the extremity and sometimes tinged with that color at base. A yellow or ferruginous spot between the antennæ; these last black above, ferruginous beneath; often the scape is chestnut-bay beneath and at base. Posterior border of the prothorax marked with a narrow yellow line; the anterior and lateral borders rufous. Scutellum often bordered with yellow or tawny anteriorly, or with two yellow marks; post-scutel yellow, with the anterior border black; petiole a little ferruginous on the sides and on its narrow part; the two first segments of the abdomen bordered by a yellow cordon; the lamellar border of the second and the margins of the following testaceous-rufous. Feet sombre ferruginous; black at the base. Wings smoky. Wing scales ferruginous, marked with a yellow dot on their posterior margin.

♀. Clypeus black, with a yellow macula on each side near the

top, or bordered with yellow on its lateral margins, or entirely black.

♂. Clypeus yellow, covered with a silvery pile; the flagellum of the antennæ more ferruginous at base, black in its second part, with a moderate ferruginous hook. Thorax a little more elongate.

Var. Clypeus bordered all round with black.

Var. In both sexes, the teeth of the clypeus are more or less spiniform, sometimes the notch between them is filled by a little arcuated border, which makes the teeth short and not spiniform. The dilated part of the petiole is more or less wide; more or less bidentate, or not bidentate; the frontal and mesothoracic sulcosity not distinct.

a. Clypeus and head entirely black. Anterior border of the prothorax and scutellum black. Petiole without ferruginous.

b. Clypeus margined on both sides with yellow.

c. Mesothorax with two rufous lines; scutels bordered with yellow.

d. The metathorax and mesopleuræ passing to ferruginous.

e. The end of petiole mixed with brown, or with two transverse lines, smelted with the yellow border.

f. Abdomen passing to brown.

g. The yellow marking of the thorax more or less wanting; no spot on the wing scale.

Rees. a. diff.—This species is very near to the *E. callimorphus* Sauss., but is distinguished from it by certain characters difficult to describe. The clypeus is flatter; its teeth are a little shorter; the ocelli are placed upon a less arcuate line, and the vertex has two transverse grooves between the summit of the eyes and the external ocelli. The thorax is more coarsely and less densely punctured and above all wider and larger in proportion; its angles are a little upturned at the shoulders. The petiole is shorter; its dilatation is more funnel shaped, less pyriform. The second segment seen from above is a little more sinuous, which renders the lamellar edge more salient. The abdomen is more distinctly punctured. The coloration, finally, is strongly analogous. Distinct from *E. regulus* and *totonacus* by its larger size, and its flattened, bidentate clypeus, etc. Differs from *E. olmecus* by its smaller size, punctate, not velutinous thorax, more

inflated petiole, shorter 2d segment, with rather sinuated margin, etc. See also the *E. Nortoniana* and *Cressoniana*.

Hab. The Gulf side of Mexico. (I have taken some specimens of it at Tampico.) The Oriental Cordillera, Banio (Mr. Sumichrast). 9 ♀, 5 ♂.

Nota.—Mr. Sumichrast attributes to this insect a most interesting nest. It is formed of a mass of cellules or habitations composed of a black bark which seems to be agglutinated by some gummy material. These habitations are more or less cylindrical and gummed one against another. But although they form a double row, they are not always parallel like the cells of social wasps, but a little oblique the one upon the other, which renders their arrangement quite irregular. This nest is fixed upon a little branch of the oak. It greatly resembles in its system that of *Zethus Romandinus*, which I have cited as apropos of this species. But its surface, instead of being fibrous, is here cellulous-rugose; one remarks here some little rounded or polygonal cells, the borders of which form a sort of reticulation, which is, however, but a simple sculpture; the fossettes are too small to be compared to basal sockets, and have absolutely nothing in common with the outlines of cells which one often finds on the borders of wasps' nests. I should not be surprised if this nest should be rather that of a *Zethus* than of the *E. mexicanus*, and that it should prove to be an error in the "etiquette" mark.

16. *E. Sumichrasti* n. sp.—*Crassiusculus*, niger; clypeo bidentato; thorace quadrato, tenuissime ruguloso; abdomine nitido, petiolo sparse punctato, campanulato, incrassato-marginato; apice sulco diviso; frontis macula, margine postico pronoti, abdominis segmentorum 1ⁱ, 2ⁱ limbo, post-scutelloque, flavis. ♀.

Total length, 11 mill.; wing, 8.3 mill.

♀. Quite closely related to *E. Mexicanus*. A little larger. Clypeus bidentate, not so much flattened. Thorax a little longer, not so distinctly punctured but quite delicately shagreened all over. The petiole more campanulate, wider, truncate; much swelled, also bordered by a salient cordon, but parted by a groove with a shallow impression before the border; 2d segment rather elongate, the lamellar edge very narrow, hardly distinct, although the first edge is not thick.

Black, with grayish-silky reflection; abdomen silky-shining,

very delicately punctured; the petiole distinctly punctured. Mandibles in part, antennæ beneath, tegulæ, knees and tibiæ partly rufo-fuscos; a dot between the antennæ, a line behind the eyes, hind border of prothorax, post-scutel and border of segment 1st, 2d, yellow; the rest of the abdomen, even the lamellar edge of 2d segment, quite black. Wings cloudy.

Res. a. diff — Resembles very much *E. Santa-Anna* and *lævis*, in the form of its petiole, but this is parted by a groove at the end, and the thorax is shagreened; the petiole is also shorter.

Hab. Mexico; the Oriental Cordillera. Orizaba (Mr. Sumichrast).

17. *E. Brasilanus* n. sp.—Niger; clypeo nigro, apice bidentato; thorace punctato, quadrato, pronoti margine postico ferrugineo vel flavo, tegularum margine ferrugineo; abdominis segmentorum margine 1-5 flavo limbo; mandibulis, tibiis et tarsis antice ferrugineis, reliquis ferruginescentibus; alis subinfuscat. ♀.

♀. Total length, 10½ mm.; wing, 8½ mm.

♀. This insect is exactly like the *E. mexicanus*, and only differs from it in certain characters.

The clypeus is less flattened, and is not shining but dull; there is hardly any frontal carina. The punctuation of the body is apparently the same or a little more dense. The scutellum is a little less strongly cribose. The antennæ are scarcely ferruginous beneath. The clypeus and the scutels are entirely black; the segments 3-5 have their borders delicately ornamented with yellow above and beneath.

This species may be but a variety of the *E. mexicanus*. In both species the 2d cubital cellule of the wing is quite large, trapeziform, with straight borders; the radial border is large.

Hab. Brazil. (The author's collection.)

18. *E. lævis* MIMI.—Niger, cinereo-sericeus, lævis, fere impunctatus; clypeo acute bidentato; thorace antice quadrato; abdomine depresso; petiolo depresso-gibboso; mandibulis et antennis subtus, ferrugineis; linea scapi antennarum, lineola pronoti marginis postici et tenuissima marginis antici, fascia scutelli, lineis 2 metanoti et margine petioli, flavis; abdominis segmentis rufo marginatis, fascia præmarginali flava; tibiis flavo-variis; alis fusciscentibus. ♀.

Variat. abd. segm. margine 30-50 ferrugineo.

E. cingulatus SAUSS. Et. Vesp., III, 151, 41 (Syn. excl.).

Total length, 12 mm.; wing, 9 mm.

This species has not been sufficiently well described.

♀. Clypeus flattened, polished; its apex carinated into two very acute teeth, separated by a shallow notch. Thorax globular, polished, square anteriorly, with its angles insensibly raised. Metathorax very delicately punctured, parted by a channel. Abdomen polished, much depressed; the second half of the petiole rather wide, although swelled above; the hind margin of the second segment straight; not sinuous.

Insect black, with an argenteous reflection. Antennæ slender, ferruginous below at the apex; frequently a yellow line on the scape. A spot on the forehead and in the sinus of the eyes, yellow. A narrow interrupted line on the anterior border of the prothorax, a line on the posterior margin, a spot before the wing, two dots on the anterior angles of the scutellum, a band on the post-scutellum, and two lines on the metathorax, yellow; the margin of the first two abdominal segments also bordered with a yellow line; that of the petiole smelted with two lateral spots; the lamellar borders of segments 2d and following, rufo-testaceous; this color preceded by a fine yellow line. Coxæ and tibiæ ornamented with yellow. Wings cloudy, with golden reflection.

Res. a. diff.—This species approaches very much to *E. callimorpha*, but its abdomen is much depressed; the petiole not so long, more dilated; the clypeus less notched. The thorax, although more polished, has just the same form. In its appearance this *Eumenes* quite resembles *E. mexicanus*, but it is larger, the clypeus is more ovoid, not so pyriform; the body is not punctured, and the thorax is a little longer than wide. In its depressed abdomen and its impunctured body, it quite resembles *E. Santa-Anna*, but it is more slender, less depressed; the thorax has another appearance, etc. Nevertheless, it annoys me much to separate *E. lævis* from *E. Santa-Anna*, but the first seems to be a smaller Brazilian representative of the last.

Hab. Brazil; Para. (The type in the collection of Spinola, Turin mus., and in the author's collection.)

Observation.—The Fabrician synonym is very doubtful; I first adopted it according to the collection of Spinola, but the description given by Fabr. does not fit our insect, which, as we think, must be considered a different one.

19. *E. Novaræ* SAUSS.—*Gracilis, niger, flavo et badio tenuiter variegatus; antennis subtus ferrugineis; clypeo bidentato; abdomine depresso, segmentis anguste flavo-limbatis; petiolo elongato, piriformi.*

E. Novaræ SAUSS. Reise d. Oesterr. Fregat. Novara, Zool., II, Hymen. 6, 1, fig. 3.

Total length, 14 mm.; wing, 10½ mm.

♀. Black, sericeous. Thorax short, globular, very convex. Petiole elongate, not campanular, bordered by a cordon. Body very delicately punctate, the metathorax a little more strongly, argenteo-sericeous. The extremity of the mandibles, teeth of the clypeus, antennæ beneath, a spot on the forehead, fulvo-ferruginous; base of mandibles, lateral border of clypeus, a dot in the sinus of the eye, and a line behind their summit, yellow; a line on the hind margin of prothorax and a line on each angle and border of tegulæ, ferruginous; two spots on the angles of scutel, a line on post-scutel, a dot and a line on the sides of thorax, and a little line on the margins of the segments of abdomen, yellow. Feet black with the coxæ maculate with yellow; knees and tibiæ outside yellow. Wings hyaline, with black nerves and the anterior margin narrowly brown.

Var. All the ornaments more or less yellow or ferruginous.

RESS. a. diff.—This species has a depressed form; it resembles *E. Santa-Anna*, although it is not so much depressed, and more slender. It comes very close to *E. lævis*, but with a shorter thorax. Not having the type, I dare not give a more approximate composition. It is a little larger than *E. olmecus*, and a little smaller than *E. Santa-Anna*.

Hab. Brazil, Rio Janeiro. (Museum of Vienna.)

20. *E. minutus* FABR.—*E. regulo paulo major, niger, punctatus, aureo-sericeus; clypeo convexiusculo, punctulato; antennis subtus ferrugineo-variis; pronoti margine postico, post-scutello abdominisque segmentorum limbo, flavis; pedibus nigris, tibiis et tarsis obscure ferrugineis; alis subinfuscatis.* ♀.

? *Eumenes minuta* FABR. Syst. Piez., 291, 23 (1804).

Total length, 9 mm.; wing, 7 mm.

♀. A species extremely near to *E. mexicanus*. Size a little smaller; body a little more slender; clypeus slightly convex, punctured and ovoid, subemarginate at tip (not strongly biden-

tate); no frontal carina. Thorax smaller, a little shorter; the angles of the prothorax not upturned; the petiole more slender; the second abdominal segment a little shorter and with a less sinuous border. The scutellum having about the same punctuations as the rest of the thorax.

Insect black, clothed with a golden pile; antennæ slightly varied with ferruginous beneath; a yellow line behind the summit of the eyes; posterior margin of the prothorax and post-scutellum marked with a honey-yellow cordon; anterior border of the prothorax on each side a little tawny; a feeble dot under the wing and the post-tergite yellow, as well as a narrow border on all the segments of the abdomen. (The second lamina of the border of the second segment, also yellow.) Wing scale black, bordered with brown. Feet black, tibiae outside and tarsi ferruginous. Wings slightly smoky, stigma opaque.

Res. a. diff.—It is larger than *E. regulus*, the thorax not covered with strong punctures but finely and densely punctured; the end of petiole not so much canaliculate before the margin. It comes quite near *E. totonacus*, but is a little larger, the thorax more densely punctured; the scutellum not gibbous and not parted.

Hab. Brazil.

21. *E. cingulatus* FABR.

Eumenes cingulata FABR. S. P., 267, 13 (1804).—SAUSS. Vespides, III, 151, 41.

Hab. Cayenne. (Typus Saussurii in mus. Spinolæ, Taurinensi.)

22. *E. parvulus* SAUSS.

Eumenes parvulus SAUSS. Vespides, III, 149, 37, pl. viii, fig. 5, 5a (1854).

Hab. Brazil. (Typus in museo Parisiensi.)

23. *E. pusillus* SAUSS.

Eumenes pusillus SAUSS. Vespides, III, 149, 38 (1854).

Hab. Brazil. (Typus in museo Parisiensi.)

24. *E. microscopicus* SAUSS.

Eumenes microscopica SAUSS. Vespides, I, 72, 62 (1852).

Hab. Brazil. (Typus in museo Parisiensi.)

These species are imperfectly known; I do not possess them in my collection, and it may be possible that our *E. minutus* proves to be one of them.

C. Thorax not so wide; longer than broad; not larger, or even smaller than the pear of the abdomen. (Form very much as in Division Alpha.)

25. *E. callimorphus* SAUSS.—Niger, lævis, gracilis; clypeo valde bidentato; thorace tenuiter dense punctato, mesonoto laud sulcato; abdomine gracili, petiolo subelongato, angusto; antennarum articulis 1-4 plus minusve ferrugineis; corpore ut in *E. Mexicano* flavo-ornato, petiolo utrinque linea flava.

Total length, 14 mm.; wing, 9 mm.

E. callimorpha SAUSS. Et. Vesp., I, 71, 61, pl. xiii, fig. 4; ibid. III, 148.

† *E. campanulata* FABR. S. P., 291, 22, ♀.

Clypeus terminated by two spiniform teeth. A more or less distinct frontal carina. Thorax quadrate before, delicately punctured; its angles slightly reflexed. Petiole elongate; its pear-shaped part slender, truncate, bordered, and channelled as in the other species. The abdomen depressed.

Black, covered with a very short silvery pile; the abdomen quite polished; the pile making it appear tenously strigate. Antennæ beneath, a part of the mandibles, and teeth of clypeus, ferruginous. A spot on the forehead, one in the sinus of each eye, a line behind the eyes, yellow tawny; both borders of prothorax, (the anterior one interrupted), a spot under the wing, post-tegulae, anterior border of scutels, posterior border of the abdominal segments, a line all along the sides of the petiole and an oblique spot smelted on each side with its border, yellow or rather ferruginous. The extreme margin of the segments 2-5, brown. Knees, tibiae, and tarsi most ferruginous. Wings smoky.

♀. Clypeus black, with two yellow spots near the top; its teeth spiniform, carinated.

♂. Clypeus yellow, argenteous; its teeth not so sharp, not carinated.

Var. The colors are more or less developed, as in other species. The legs more or less ferruginous, at times entirely red; the petiole beneath and on the sides is of the same color; no yellow line upon the scutellum. The clypeus is more or less strongly

bidentate, the teeth are at times long, sharp, separated by an angular notch; often less long and separated by a shallow notch like the arc of a circle; a little carina often parts the anterior margin of the scutel. Wings with some violet reflections.

Res. a. diff.—This is larger and more slender than all the preceding, but smaller than *E. olmecus*. It makes the transition to the Division *Alpha*. It has the same coloration as most of the species of the same division, except that it possesses all along each side of the petiole a yellow line. The petiole and the pear of the abdomen are also more elongate, the 2d segment longer than wide.

Hab. Brazil. 2 ♀, 1 ♂ from Bahia. 2 ♀ (coll. Spinola), from Rio Janeiro.

The description which Fabricius has given of his *E. campanulata* does not mention the two lateral yellow lines of the petiole, nor the spots of the clypeus, nor does it accord well in the antennæ with the *E. callimorpha*, for which reason we do not dare to assert positively that this is the *E. campanulata* of Fabr.

There are probably more than one species very closely allied to this which might be easily confounded with it; *f. i.*, the following description which I find in my notes seems to indicate a different species with sulcate mesonotum.

26. *E. incertus.*—*E. callimorpha* simillimus, at clypeo minus bidentato, mesonoti disco 2-vel 4-sulcato; corpore nigro; antennis subtus et tibiis extus, ferrugineis; pronoti marginibus, petioli lineis literalibus 2 et margine, segmentorumque 2-4 linea præmarginali tenuissima, sulfureis. ♀.

♀. Figure, size, and form the same as that of *E. callimorpha*, but differs in the clypeus, shining, offering also two carinæ, but less strongly bidentate; its latero-inferior borders sinuate. Thorax a little more distinctly punctured; the disk of the mesothorax offers *four longitudinal furrows*.

Insect black, shining, with silvery reflections. Antennæ ferruginous beneath; a fine line bordering the two margins of the prothorax, ferruginous or yellowish. The bordering of the petiole, a little mark on each side of the middle of it, and a spot above toward its base, sulphur-yellow, as well as a fine submarginal line upon segments 2-4, both above and beneath; the extreme border of these last, black. Tibiæ 1st, 2d, ferruginous before; wings a little smoky.

Hab. Para. (Collect. of Spinola. Collected by Mr. Ghiliani.)
May be a variety of the *E. callimorpha*?

27. *E. miles* n. sp.—Niger, punctulatus, cinereo-sericans; mandibulis pedibusque partim rufis; clypeo apice bispinoso, utrinque fascia aurantia; corpore valde aurantio-variegato; alis nigrescentibus. ♀.

Length of the wing, 10 mm.

♀. Size of *E. pomiformis*, smaller than *fraternus*.

Black, grayish-silky, shining, delicately punctured. Head rather broader than long. Mandibles very long, arcuated at tip, reddish, with a yellow spot at base. Clypeus flattened, ending in two sharp spines, in which fall two short carinæ. The borders of clypeus yellow; antennæ blackish; fulvous beneath up to the 4th joint. A spot on the forehead, one in the emargination of each eye, a line behind the eye, a fascia on the fore and on the hind margin of prothorax, a spot under the wing, the anterior margin of scutel and post-scutel, and two fasciæ on the metathorax, orange yellow. Margin of the wing scales, knees, tibiæ, and tarsi, ferruginous; the latter rather obscure above. Wings smoky, rather blackish on the costal margin, with violet reflections; 2d cubital cell broad at its hinder margin, narrow at its radial side. (Abdomen ?).

Hab. Guiana, Surinam. (Hamburg museum.)

By the form of its clypeus and its silky-pubescent this species fits in this Division, but the inneuration of the wing assimilates it more to Division a.

28. *E. Olmecus* n. sp.—Niger, punctulatus; clypeo apice bispinoso; thorace superne convexo, metathorace angustiore in clunis 2 per sulcum profundum diviso; petiolo elongato-piriformi, apice truncato, marginato; antennis subtus pedibusque partim, obscure-ferrugineis; capitis maculis, pronoti limbo postico et utrinque antico, abdominis segmentorum margine subtus obscure-ferrugineis vel flavescentibus; post-scutelli linea, margineque segmentorum 1ⁱ, 2ⁱ, flavis; alis costa nigra. ♀.

Total length, 14 mm.; wing, 10 mm.

♀. Antennæ slender. Clypeus bidentate at tip; the labrum large, truncate; ocelli disposed in an arcuate line. Thorax quadrate anteriorly, short, convex, delicately punctate and velutinous; behind the angles of the prothorax an obsolete depression. Metathorax compressed, angulated; parted by a deep groove;

its lateral ridges sharp. Petiole as in *Iturbide*, elongate-pyriform, truncate, convex, not parted by a channel; the hind margin bordered, the border preceded by a transverse channel. The rest of the abdomen depressed.

Black, with a fulvous or purple-silky reflection. The extremity of the labrum, the lateral borders of clypeus, a spot between the antennæ, a dot in the emargination of the eyes, the antennæ beneath, the end of mandibles, and a line behind the top of the eyes, tawny. The hinder margin of prothorax, an interrupted line on the anterior margin, or only on its angles, a line over the middle coxæ, tawny; wing scale brown or ferruginous; two dots on the anterior angles of scutel, a line on the post-scutel, and the margin of segment 1st, 2d, yellow; the lamellar margin of 2d segment and of those following, brownish. Beneath, the margin of the segments fulvous. Feet ferruginous and blackish. Wings hyaline, smoky, with iridescent reflection; the anterior margin blackish.

Var. The spots on the head and hinder margin of prothorax, yellow; two yellow dots on the clypeus; scape of antennæ almost wholly ferruginous.

Res. a. diff.—This species is quite intermediate between the Divisions *Pachymenes*, *Alpha*, and *Omicron*; or between *E. Santa-Anna*, *Iturbide*, and *callimorphus*. The clypeus is bidentate and the abdomen elongate depressed as in the *Pachymenes*; but the thorax is not depressed, but on the contrary convex, not polished as in *E. Santa-Anna*, but densely punctured, and the petiole not so widened, not campanulate but *gradually* widened.

It differs from *E. Iturbide* by its depressed, not globular or subcompressed 2d abdominal segment; its flattened clypeus with spiniform (not lamellar) teeth; its compressed triangular metathorax; its petiole without impressed point at tip, but with a transverse submarginal channel. From *E. callimorphus* and the other species of Division *Omicron* by its large size; its more depressed and elongate abdomen; its compressed, prominent metathorax parted by a deep groove, and by its general resemblance to Division *Alpha*.

Hab. Mexico. The Oriental Cordillera. I caught 3 ♀ in the neighborhood of Cordova.

29. *E. infernalis* n. sp.—*Gracilis, niger rufo-ornatus*; clypeo bidentato; thorace dense foraminato-punctato; abdomine polito, segmentis

1,♂ 2♂ *flavo-limbatis*; 2♂ *superne gibbo crasse cribrato-punctato instructo*. ♀.

Total length, 12 mm.; wing, 8 mm.

♀. Form almost like that of *E. callimorphus*. Head dotted with punctures. Ocelli in a slightly arcuate line. Clypeus quite flat, pyriform, notched and terminated by two sharp lamellate teeth. Thorax very convex, especially behind; the wings inserted behind the middle; all the surface densely cribrate with pit-like punctures, more strong than those of the head; these punctures become more strong upon the scutellum and very dense on the metathorax. Abdomen smooth, shining, without punctures. Petiole quite long and slender; almost filiform in its first moiety, then swelled pyriform, truncate, convex, shining; the posterior border preceded by a transverse groove. The 2d segment before the middle of its dorsal face strongly elevated in form of a boss, slightly compressed and cribrate with punctures; a sort of shining canal passes around behind this gibbosity. The other segments shining, black. Mandibles and antennæ ferruginous; these last, obscure above, with the scape a little yellowish before. The two lateral borders of the clypeus as far as the end of the teeth yellow, as well as a little spot on the front and the posterior border of the prothorax. Wing scales reddish or brown. Segments of the abdomen all ornamented with a yellow border. Petiole offering on its middle two little yellow or reddish marks; its posterior border yellow or reddish, at least in the middle; its lower side more or less reddish. Legs reddish; coxæ black; femora brown; the two anterior spotted with yellow toward the end. Wings slightly washed with brown-ferruginous, having brown nervures.

Var. a. The thorax more or less varied with ferruginous.

b. Posterior border of prothorax, ferruginous; the borders of segments 3-5, ferruginous or brown.

c. The anterior border of prothorax, a spot under the wing, two spots or a band on the scutellum, two spots on the metathorax, ferruginous or yellowish; legs brownish or ferruginous in part.

Res. a. diff.—This species has the thorax a little more lengthened anteriorly, and the head and thorax much more strongly punctured than the *E. callimorphus*. It is very distinct:

in the strongly cribose boss of the second abdominal segment. It differs from *E. mexicanus* in its much larger size, in its less strongly cribose, less globular metathorax. In fact, the form, swelled and cribose above, of the 2d abdominal segment, distinguishes the *E. infernalis* from all others of the Division *Omicron*. This character is a transition to the Division *Alpha*, which constitutes an exception in the Division *Omicron*.

Hub. Brazil. Para. (Coll. Spinola.) Guiana. (Mus. of Hamburg.)

Division BETA.

Mandibles rather hooked at end, or truncate. Head in form of a transverse oval, not rounded-triangular; the eyes very large in their inferior part. Thorax not larger than the pear of the abdomen, globular or cubic. Petiole elongate, filiform, cylindrical, only very little dilated at the end in a funnel shape,¹ its posterior border marked with an impressed point. The 2d segment not depressed, not compressed.

These insects slightly resemble in form the *Pareumenes*; but they are much more slender. The thorax has quite another shape, not being widened and depressed, but cubic, more as in Division *Omicron*, although smaller. The abdomen also is not depressed, but the petiole quite recalls the form it has in *Pareumenes*, although much more slender.

The mandibles are rather hooked, strongly dentate as in *Pachymenes*, but *by exception* short and blunt (♀) more as in *Zethus*.

This Division is intermediate between the *Pareumenes* and the *Eumenes* of Division *Omicron*.

a. Mandibles short, pointed in the males, blunt, rounded at tip, with separated small teeth in the females.

30. *E. Nortonianus* n. sp.—Niger, dense crassiuscule punctatus; oculis infere valde inflatis; mandibulis brevibus, ♀ apice rotundatis; clypeo pentagonali, bidentulo; carina frontali nulla; petiolo elongato, filiformi, apice tenuiter, cylindrico-infundibuliformi, puncto apicali impresso; abdomine dense punctato; puncto frontali, marginibus pro-

¹ Not campanulate, more pear-shaped as in Division *Alpha* or *Omicron*, but filiform, widened at end somewhat like a clarinet. Seen from above, the sides of the petiole are not arcuate-convex but rather arcuate-concave.

noti et post-scutelli, rufis; pedibus et antennis partim ferrugineis; abdominis segmentorum 1ⁱ, 2ⁱ marginibus flavo; alis fumosis.

♀. Total length, 11 mm.; wing, 8 mm.

♂. Total length, 10 mm.; wing, 7.5 mm.

Very similar to *E. mexicanus* in its appearance, but a very different type. Head transverse-oval; eyes very much inflated.

Head more strongly punctured over the antennæ; no frontal vertical carina, but the space between the antennæ flat. Thorax small, more densely and coarsely shagreened; roughish; the metathorax as coarsely shagreened as the mesothorax. Post-scutel with a little arcuate crest on its anterior margin.

Petiole elongate, as long as head and thorax, arcuate, more filiform and cylindrical; not at all campanulate or pear-shaped, but only a little funnel-shaped in the last third¹ (the lateral margins forming not a somewhat convex line but a somewhat concave one). Its extremity not rimmed nor canaliculate transversely, but having a marginal impression above only, which forces backward the middle of the border. The 2d segment not depressed nor compressed. Petiole and second segment densely and rather coarsely punctured; the following polished.

Black, grayish-silky; antennæ beneath, margin of the tegulæ, and feet partly, dull-ferruginous; a spot in the sinus of the eyes, a frontal spot, both margins of prothorax, a little line under the wing, post-tegulæ, two spots on scutel and post-scutel, dull ferruginous; the margin of segments 1st, 2d of the abdomen, yellow. Petiole beneath and above in the middle, brown-ferruginous. The lamellar margin of the second segment, piceous; the margin of the following, testaceous or yellowish. Feet ferruginous, brown against the base. Wings subhyaline or smoky; nerves brown.

♀. Clypeus black, rather pentagonal, not elongate, delicately punctured; its inferior border arcuate, scarcely bidentate; the teeth small, not distant, or formed by two little parallel marginal carinæ; its superior margins brownish. Mandibles short, rather dilated at the extremity, rounded (or the outer margin arcuate, the inner one obliquely truncate), with small teeth. When resting, they retract themselves behind the border of the clypeus, crossing their teeth one into the other.

♂. Clypeus black, argenteous, with a rufous or yellow line on

¹ Somewhat like a straight trumpet or a clarinet.

each side; hook of the antennæ ferruginous. Mandibles short, but triangular, acute, with four little teeth.

Res. a. diff.—This insect, although having quite the general appearance of an *Eumenes*, approaches *Discælius* in the form of its mandibles, short and widened towards the tip in the female. But it is very easy to confound it with *E. mexicanus* and *callimorpha*. It differs by its rather convex clypeus, not so bidentate, by the absence of frontal carina, by its head transverse-oval, not oval-triangular, because of the great enlargement of the under part of the eyes, which is wider transversely than longitudinally, and by its shagreened abdomen. The exceptional form of the mandibles, truncate and rounded at the end, with the external side very arcuate, as also the particular form of petiole, will distinguish this species from all its neighbors.

This is quite an exceptional type, remarkable by the unequal form of mandibles in both sexes.

Hab. Mexico. The Oriental Cordillera. Cordova. 2 ♀, 1 ♂.

b. Mandibles more elongate, not truncate, rather hooked at tip, with strong teeth on the interior margin.

31. *E. Cressonianus* n. sp.—Niger, cinereo-hirtus, valde punctatus; clypei marginibus lateralibus, puncto frontali et orbitarum sinus, marginibus pronoti, lineaque præ tegulis, post-scutello, margineque petioli et 2ⁱ segmenti, flavis; petiolo medio flavescente, puncto apicali impresso, haud in marginem producto; segmentis 20-50 fusco-marginatis. ♀.

Total length, 11 mm.; wing, 8 mm.

♀. Quite the same form as in *Nortonianus*, but the mandibles elongate, not truncate, arcuate at tip; the internal border armed with four strong lobular teeth; the clypeus emarginate in a little arc of a circle. The thorax not so rugose; not roughly shagreened, but more polished and cribose with coarse punctures; the metathorax not so coarsely punctured; the post-scutel without any crest. The extremity of the petiole a little margined; its impressed point not intrenching upon the margin. The second segment a little depressed, a little more strongly and less densely punctured.

Black, with the same ornaments as in *Nortonianus*, but of yellow color; the antennæ beneath and tip of mandibles ferruginous. Feet ferruginous, blackish at base; the tibiæ yellow outside. Wings smoky. The scutel not spotted.

Res. a. diff.—Differs from *Mexicanus* and all the species of Division *Omnicron* by the form of its petiole.

Hab. Mexico; the Oriental part. Cordova.

32. *E. simulans* n. sp.—Niger, sulfureo multipictus, histrionicus; thorace crasse cribrato-punctato, mesonoto fasciis 2 flavis; abdomine punctato, petiolo lineari, apice tenuiter infundibuliformi; secundo segmento facii 2 transversis flavis. ♀.

♀. Total length, 11 mm.; wing, 9 mm.

♀. Head transverse-elliptic, very punctate. Mandibles elongate, rather hooked at the tip, and armed with three strong lateral teeth. Clypeus polygonal, a little longer than broad, a little emarginate and bidentate at tip. Eyes very large inferiorly, their sinus deep, rather triangular. Thorax small, globular, metathorax quite rounded. Petiole moderately long; its second part funnel-shaped, with an impressed point at end. The petiole and 2d segment of abdomen punctate; this is neither depressed nor compressed.

Black, with yellow hair. The head beneath, clypeus, mandibles, the orbits all round, their sinus, a transverse line on the vertex, sulphur-yellow. Antennæ orange-ferruginous, obscure above; the scape yellow. Thorax beneath and on the flanks, both margins of prothorax, two lines on mesothorax, tegulæ, scutel partly, post-scutel, and metathorax more or less, yellow; this with a sort of black T. The middle of the petiole, posterior margin, and sides, yellow; 2d segment with two yellow fasciæ; the first placed on the middle of the segment, the second being submarginal; both fused together on the sides; the other segments with sinuous yellow margins; anus and abdomen beneath quite yellow; the lamellar margin of 2d segment, brown. Feet yellow; the femora brown above. Wings hyaline, washed with amber, a little gray at the extremity.

Var. The black and yellow colors are more or less extended. Pleuræ and metathorax only maculate with yellow.

Res. a. diff.—A quite distinct species. By its forms only it resembles *E. Nortonianus* and *Cressonianus*. The petiole is a little more widened behind, and the body much more coarsely punctured. It might be compared with *E. Smithii*, *americanus*, etc., which have also two fasciæ on the 2d segment, but the petiole in these is pyriform and the second segment compressed, etc.

Hab. Mexico. Oriental Cordillera. Moyoapam.

This is a sort of *mimic species*. It bears the coloration and rather the form of some *Polybia*, *f. i.*, *P. fasciata* Lep. We know a *Cerceris* of the same country¹ which shows the same peculiarity. Entomologists ought to study whether these insects of mimic resemblance do not have some relationship in their habits.

Division ALPHA (*Eumenes proprie dicti*).

(SAUSS. Vespides, I, 28; III, 128, 137.)

Mandibles long, dentate. Clypeus pyriform, notched or truncated at the extremity. Antennæ generally inserted above the middle of the head. Ocelli arranged in a broad triangle. Thorax generally longer than wide; squarely truncated before, but without salient angles; metathorax convex, but not prolonged, rounded and having two distinct convexities separated by a channel. Petiole of the length of the thorax, linear at its base; about the middle rather suddenly swelled into the form of a club or of a truncate pear, or campanulate; feebly bidentate (or bituberculate) in the middle, generally bordered by a salient cordon; the swelling generally parted by a groove, and having an impressed point before the margin. Pyriform part of the abdomen globular or compressed, or at least not much depressed. Antennæ of the males terminated by a hook.

The body of these insects is in general densely punctured and covered with thick sub-woolly hair, and the clypeus of the males is usually yellow, clothed with a silvery pile, while among the females it is only marked with yellow. But these characters suffer certain exceptions among the American species.

As it was said, there is no regular limit between this group and the Division Omicron, but if we compare the extreme forms of both, as for instance *E. globicollis* or *aviculus* with *E. globulosus*, there will be an easy distinction of both types, which exists no longer if we compare all the species. In general terms we can say that here the thorax is often more lengthened; the metathorax more parted; the petiole more *campanulate*; the extremity of this

¹ *Cerceris simulans* SAUSS. Reise d. Oesterr. Fregatte Novara. Hymenopt., p. 81, No. 1, fig. 53. In this, even the forms of *Cerceris* are so modified as to approximate to those of *Polybia*, the abdomen becoming elongate-petiolate.

is sometimes not margined, sometimes margined by a little cordon; this is not preceded by a regular channel as in Division *Omicron*, but rather by three impressions, which makes the salient margin appear somewhat bidentate before; the impression of the middle is always the most distinct.

A. Large species, with black wings. The pear of the abdomen rather depressed; that is, not compressed.

a. Body smooth, shining, not punctured. (Thorax elongate, petiole strongly campanular; its swelled part convex, not parted by a groove, its margin preceded by a channel as in Division Omicron.

33. E. Aztecus SAUSS.—Validus, ater, nitidus, haud punctatus; pronoti margine postico medio, post-scutello, petioli margine, et abd. secundi segmenti limbi fascia interrupta, pallide ochraceis; antennis et tarsis anticis subtus ferrugineis; alis nigro-cæruleis. ♀.

Total length, 23 mm.; wing, 17 mm.

Eumenes Aztecus SAUSS. Revue et Mag. de Zool., IX, 1857, 272.

♀. Large, black, smooth, and polished, without punctures: the body throughout smooth, shining, and satin-like, nearly glabrous, with neither punctures nor distinct striæ, even on the metathorax or the petiole. Clypeus bidentate at the extremity, smooth and polished like the remainder of the body. Its emargination angular. Thorax long; disk of mesothorax lengthened. Pyriform part of petiole wide, strongly campanulate; little swelled, convex above; its posterior border formed by a salient cordon preceded by a channel. Second abdominal segment depressed; but the end of the abdomen a little compressed (without this last character this insect would have the appearance of a *Pachymenes*).

Antennæ long and slender, black, ferruginous beneath. Feet black; tibiæ and anterior tarsi with golden hairs, appearing yellow. A little arcuate line in the middle of the posterior border of the prothorax, two dots on the scutellum, post-scutel, and a narrow edging on the margin of petiole, pale tawny; second segment generally marked with a pale-tawny submarginal border, narrow and widely interrupted in the middle. Wings black, varied with very deep-violet reflections.

Var. Only the post-scutel and the petiole marked with pale tawny.

Res. a. diff.—This handsome species has no similarity to any but the *E. flavicornis*, and to the *E. Wagneriana*, from which it is easily distinguished by its notched clypeus and its body without sculpture.

Hab. The gulf side of Mexico. Tampico.

Observation.—One can discover with a strong magnifier, a fine sculpture on the thorax and elsewhere; the scutellum in particular is very finely punctured, but we only speak here of characters easy to discover and relative to those of other species.

b. Body punctured. Petiole elongate; its dilatation flattened-elongate, parted by a groove, not sensibly margined. (Passage to the Division Zeta.)

34. *E. flavicornis* SAUSS.—Validus, carbonarius, *E. Wagneriano* simillimus, at clypeo truncato, haud bicarinato; antennis, clypeo, orbitis, macula frontali mandibulisque apice, aurantiis; antennis ♂ apice haud uncinatis, sulco minuto subtus notatis. Long. 25 mm.

E. flavicornis SAUSS. Et. Vesp. III, 141, 27; pl. vii, fig. 4, ♂ (Syn. excl.).

Hab. Venezuela. (Museum auctoris.)

35. *E. Wagnerianus* n. sp.—Niger, sericeus; thorace dense punctato, petiolo depresso, sulco partito; clypeo ♀ valde bicarinato, apice subexciso; alis nigro-violaceis.

Total length, 23–24 mm.; wing, 21 mm.

♀. Large, black, shining; head and thorax finely punctured. The whole body clothed with a fine grayish pile. Clypeus rather rugose, punctured and striate, lengthened and widely truncate at its inferior border and slightly notched, its angles rounded, receiving two strong parallel distant carinae which cross the clypeus for about two-thirds of its length. Prothorax slightly retracted, rimmed; its angles a little salient. Abdomen depressed, smooth, and silky, with silvery reflections; enlargement of petiole flattened, wide, and lengthened, divided by an impressed line. The whole body of a deep black. Wings of a deep brown, with violet reflections.

Res. a. diff.—This species very much resembles—

1st. The *E. aztecus*, from which it is distinguished by its distinctly punctured thorax, by its much longer clypeus, rugose, more flattened, not bidentate; by the enlargement of the petiole,

more lengthened, not bossed and divided by a strong groove; by its angulate prothorax, etc.

2d. The *E. flavicornis*, of which it has the form and the punctuation.

3d. The *E. niger* Brullé, from which it differs by its emarginate clypeus, in the ♀; by the more lengthened, less dilated enlargement of the petiole, etc.

Hab. The Isthmus of Panama. (My collection.) This beautiful insect was sent me by the celebrated traveller, Maurice Wagner, of Munich.

The flattened and sulcated petiole of the *E. Wagnerianus* and *flavicornis* forms an exception to the species of the Division *Alpha*, and approximates it somewhat to the Division *Zeta*, although the petiole is too wide to allow it to be classed with that Division.

B. *Smaller species, with the abdomen more globular or compressed. The border of the petiole a little margined; the margin preceded by an impression. (Regular type of Division Alpha.)*

a. Wings smoky, with violet iridescence.

36. *E. Ghilianii* SPIN.

Eumenes Ghilianii SPINOLA Hymen., rec., par Ghiliani, No. 61 (Mém. Acad. de Turin, 1846).—SAUSS. Vespides, III, 140, 26.

Hab. Brazil. Para. (Mus. Spinolæ, Taurinense.)

37. *E. fraternus* SAY.—Niger, dense punctatus, cinereo-hirtus; abdomine nitido; lineola verticali inter antennis, clypeo summo, pronoti margine, post-scutello, metanoti summi maculis 2, abdominalisque segmentorum 1, 2 vel 1-3, margine, secundo maculis 2 lateralibus, sulfureis; ♂ clypeo toto luteo; segmentis abdominalibus 1-4 flavo-limbatis; metanoto impunctato.

♀. Total length, 17 mm.; wing, 12 mm.

♂. Total length, 13 mm.; wing, 9 mm.

Eumenes fraterna SAY, Long's Sec. Exped., II, 344 (Append., 77), 1, ♂ (1825).—SAY's Entomol. (Le Conte), I, 232, 2.—SAUSS. Vespides, I, 40, 17, ♀ ♂.

E. fervens SAUSS. Vespides, I, 40, 15, ♀ ♂ (1852).

E. macrops SAUSS. ibid. I, 41, 18, ♂ (var. ? 1852).

E. minuta SAUSS. ibid. I, 39, 14, ♂ (Syn. exclus.).

♀. Clypeus convex, punctured, the tip flattened, notched, and bidentate; the teeth lamellar. Head short, not dilated behind the eyes, cribose with punctures, as also the thorax, which is large, short, globular; the metathorax convex and more densely punctured; the scutels convex, much inclined, continuing the convex surface of the metathorax. Petiole at first linear, then pyriform, lengthened, and truncate, covered with punctures, insensibly bidentate in the middle and bordered posteriorly by a hardly salient cordon, before which are three depressions, of which the middle one often forms a large hollow. Second segment compressed, flat beneath, very convex above, covered with punctures, but yet smooth and shining; toward the middle of the posterior border of the second segment they are so gathered together as to form a depression (which, however, is often wanting); its posterior border with double leaves; the upper leaf thick, a little sinuous, slightly concave in the middle; the second border not being bent upward. All the body covered with a short, gray pile, not chatoyant.

Insect of a shining black; two oblique spots at the summit of the clypeus, the carina between the antennæ and two dots behind the eyes, border of the prothorax, post-scutel, often a spot under the wing, often two spots at the summit of the metathorax and at times two dots on the middle of the same, two variable dots on the sides of the second segment and along the margin of the same a scalloped border, sulphur yellow; legs black, tibiæ varied with yellow; wings brownish with violet reflections. Wing scales black, bordered with brown or spots of yellow or red. ♂ clypeus bidentate, entirely yellow or with a black dot, covered with a silvery pile; scape of the antennæ marked with a yellow line and the hook of the same ferruginous.

Var. ♀ ♂. The second abdominal segment more or less compressed, the third and fourth segments often wholly or in part bordered with yellow. Wing scales shining, often black, or marked with a yellow dot. A yellow dot under the wing. The yellow dot behind the eye often wanting.

This is a very distinct species from its large size, its strong puncturing in the form of pin holes, from its slender form and its violet wings: from its shining black color, generally but little changed by the very short hair of the insect.

I possess some specimens, especially males, which, without exactly resembling the others, do not yet seem sufficiently different to constitute another species:—

1st. Petiole shorter and wider, with a longitudinal indistinct groove; second segment short, and all the segments bordered with whitish; wing scales ferruginous; the thorax quite villose. Size smaller. (Iowa.)

2d. Wing scales black or marked with a yellow dot; wing entirely bluish, as if steeped in pale ink, with some violent reflections, without any reddish or brownish tint; seen by their transparence, they have this same gray-violet color, while in the type they appear brown. Hooks of the antennæ blackish; the second segment seen in profile less dilated above, smoother, and less punctured. Size smaller. (New York.)

Hab. The eastern part of the United States. Very common.

This insect extends from New Orleans to Canada. I have more than forty specimens, which I have collected in Louisiana, in South Carolina, in New York, or which have been sent me from Tennessee, Wisconsin, Pennsylvania (Haldeman), Illinois (B. F. Walsh), Connecticut (E. Norton).

The species is very distinct in its appearance. Though presenting a great similarity in form and coloration to the small European *Eumenes* (*E. coarctatus*), it can easily be distinguished from it by the much greater size, by the black, *shining*, not pilose body, on which the markings are little extended, and the color *straw-yellow* or whitish; by its black scutellum, with the post-scutel always yellow and often presenting two dots at the summit of the metathorax; by its *smoky or violet wings*; finally by its body, strongly cribose, even on the abdomen.

These characters, as well as the but little variable markings of this insect, form a peculiar appearance which enables one to recognize it at first sight. It is a species really special to America, and which cannot well be taken for a variety of *E. coarctatus* Lin. Although the males, of which the size is often less and among which the characters of the species are generally less well developed, resemble closely those of the *E. coarctatus*, one can, nevertheless, distinguish them by these characters and the much stronger punctures of the abdomen.

This *Eumenes* has habits analogous to those of the *Eumenes* of Europe. It constructs with argillaceous earth a nest which

resembles a sphere terminated by a little bell-mouthed neck, which it obliterates after filling. One often finds these nests in the country, joined to the upper surface of leaves, or stuck to little branches, or fastened against a wall. The insect places its eggs in it with a provision of caterpillars which can serve for the nourishment of the young larvæ. According to Say (Long's Sec. Exp., II, 346), it chooses the larvæ of nocturnal lepidoptera, but the *Eumenes* are not particular in their choice. Harris also saw the same species collect larvæ (canker worms).¹ The larva occupies about a month in its development, and the perfect insect makes its exit by piercing the walls of the cradle which is then no more to it than a prison.

b. Wings transparent or yellowish. (Body generally clothed with short woolly pile.)

* Second abdominal segment without lateral yellow spots.

38. *E. ferrugineus* CRESS.—♂. Pallide ferrugineus; orbitis, clypeo, margine antico pronoti, maculis 2 mesonoti, scutello, post-scutello, macula subalari, maculis 2 metanoti, pedibus partim, abdominis segmentorum 1, 2 margine apicali, obscure flavescens; antennis mediis nigrescentibus; alis pallide hyalino-flavidis; clypeo bidentato, ♂ argenteo. Long. $4\frac{1}{2}$ lin.

E. ferruginea CRESS. Proc. Ent. Soc., Phila., 1865, 158. ♀.

Hab. Cuba.

39. *E. iturbide* SAUSS.—*Eum. pomiformis* statura, niger, dense punctatus, fulvo-hirsutus; secundo abd. segmento supra maxime gibboso, margine canaliculato; pronoto lato, subdepresso; antennis omnino nigris; clypeo bidentato, ♂ ♀ nigro, cum macula in summo flava; macula frontali, pronoti et abd. segmentorum margine, post-scutello et macula subalari, sulfureis; tegulis, tibiis et tarsis, ferrugineis; alis subhyalinis.

Eumenes iturbide SAUSS. Revue et Mag. de Zool., IX, 1857, 271.

Total length, 13 mm.; wing, $9\frac{1}{2}$ mm.

♀. Clypeus deeply notched, very convex on its upper part; the teeth of the emargination long and triangular, slender and lamel-

¹ I have seen one of this species with the green larva of a Diurnal lepidopter. Mr. Walsh writes that he has found its nests stored with green larvæ.

late. Thorax wide, a little depressed, that is, less high than wide; cribose with thick punctures. Petiole pyriform, a little less strongly punctured than the thorax, bordered by a salient rim before which is a hollow space. Second segment covered with quite fine and dense punctures; flattened beneath, very convex, and much dilated above, into a prominent boss of an almost tubercular form; behind this boss is a species of transverse channel which forms a submarginal depression; finally the border is sensibly turned up in the middle.

Insect black, very pilose, bristling with tawny or fulvous hair, which is short and chatoyant on the abdomen. Antennæ entirely black; a spot on the middle of the summit of clypeus, a point on the face and two behind the eyes, one under the wings, post-scutel and border of all the segments, yellow; the border of the last a little scalloped. The prothorax is also ornamented with a narrow margin, twice interrupted or with three transverse spots, yellow. Wing scales red. Legs black, tibiæ and tarsi ferruginous. Wings transparent, sullied with brownish-ferruginous, or yellow often passing into ferruginous. The spots of the head and of the thorax are often wanting wholly or in part; the middle only of the prothorax bordered with yellow.

♂. Hook of the antennæ ferruginous. The remainder exactly as with the female, but the clypeus covered with a silvery pile among fresh specimens and marked at the summit with a large yellow spot.

Res. a. diff.—This species is very well characterized by the singular deformity of the second abdominal segment, which has no yellow lateral spots; by its red wing scales and by its very velvety appearance (even the scape of the antennæ is quite bristling with hair in fresh specimens), by its black clypeus, spotted with yellow in both sexes, which is different in most other species (among which the clypeus of the male only is yellow). Compare *E. olmecus*.

Hab. The temperate regions of Mexico. I have taken it in the Michoacan and in the deep baranca of Mezquitlan. One specimen, ♀, having the clypeus entirely black, was taken in Mechoacan, near Tuxpan. (Temperate region.)

Observation.—One peculiarity is worthy of remark in this species, that, contrary to the habitual rule, the male is stouter than the female.

40. *E. consobrinus* SAUSS.—Niger, fulvo hirsutus, valde punctatus; thorace depresso; abd. 2^o segmento supra compresso et inflato, margine medio transversim impresso; tegulis, tibiis et tarsis rufis; pronoti fasciola et punctis 2 humeralibus, post-scutello et abd. segmentorum margine sulfureis.

♂. Clypeo bidentato, in summo flavo-maculato.

E. consobrianus SAUSS. Et. Vesp., III, 140, 25.¹ ♂.

Total length, 11 mm.; wing, 9 mm.

♂. Clypeus punctured, velutinous, lengthened, triangular, separated by a triangular incision. Thorax a little depressed, more wide than high, but short, almost square, distinctly punctured throughout, the metathorax very densely so. Petiole punctured, pear-shaped, lengthened, and truncate, not campanulate, offering at the extremity, before the border, a sunken place; 2d segment flattened beneath, but compressed above, forming a salient boss, and presenting in the middle before its border a transverse depression, so that the border is a little elevated in the middle; this segment, above, very densely punctured, but less strongly than the thorax. A testaceous lamina extending beyond the border of all the segments.

Insect black, all the body clothed with a long yellow pile. Wing scales, hook of the antennæ ♂, tibiæ, and tarsi red; an oval spot on the summit of clypeus ♂, a point on the front, two little dots behind the summit of the eyes, two dots on the angles of the prothorax, a little line in the middle of its posterior border, post-scutel and a regular and narrow border on the segments 1–5 of the abdomen, sulphur-yellow. Tibiæ often brownish at the end. Wings subsmoky.

Hab. Brazil. (Collection of Sen. the Marquis Spinola, at Turin.)

This species, which is of the smallest size, approaches very much to the *E. compressus* SAUSS.

41. *E. Uruguayensis* SAUSS.

Eumenes Uruguayensis SAUSS. Vespides, III, 139, 24, pl. vii, fig. 6, 1854.

Hab. Uruguay. Monte-Video. (Typus in mus. Parisiensis.)

¹ L. c. 3me ligne de la description, au lieu de: *base*, lisez *basse*.

Ibid. 6me ligne de la description, au lieu de: *bout*, lisez *haut*.



42. *E. placidus* SMITH.—Niger, antennis, pronoto, metanoto utrinque, petiolo partim pedibusque, rufis; antennis superne partim nigris; pronoti margine postico abdominisque segmentorum 1ⁱ, 2ⁱ limbo, 3ⁱ–5ⁱ fascia abbreviata, flavis. (*E. Uruguayensi* affinis species.) Longit. 4 $\frac{3}{4}$ lin.

Eumenes placidus SMITH Trans. Ent. Soc., London, 3d series, I, p. 37, (1862).

Hab. Panama.

**** Second abdominal segment with a yellow spot on each side (sometimes wanting in variety).**

43. *E. globulosus* SAUSS.—Niger, dense punctatus, subferrugineo-hirtus; abdomine nitido, fulvo-subsericeo; petiolo brevior; clypeo summo, lineola inter antennis, punctulo pone oculos, pronoti margine, macula subalarl, scutelli maculis 2, post-scutello, maculis 2 in summo metanoto, abd. segmentorum marginibus, secundique maculis obliquis 2 lateralibus, flavis: tibiis et tarsis ferrugineis, seu flavis; alis subhyalinis; tegulis flavis puncto rufo. ♀.

Eumenes globulosus SAUSS. Vespides, III, 139, 23, ♀. (1854.)

Total length, 15 mm.; wing, 10 mm.

♀. This species differs from *E. fraternus*: By the clypeus being less bidentate, much less notched; by its smaller size, and a little shorter petiole; also in the part of the same enlarged and so much divided by an obsolete channel; by its finer punctures, especially on the abdomen; by its more ferruginous pile, which is longer and gives the insect a sub-woolly appearance. Also by a more complete marking; the clypeus often presenting two yellow spots, the wing scale bordered with yellow and having a red dot in the middle; and the abdomen shining upon the quite wide borders of segments 2–5; that of the 2d being scalloped and its lateral spots often lengthened; finally by the transparent wings, slightly washed with ferruginous along the side. It is fitting to add that the yellow border of the prothorax, in place of being enlarged at its two extremities as in the *E. fraternus*, is narrow and is at times bi-interrupted.

Var. a. Clypeus black, or with two yellow marks at the summit; no subalary spot.

b. The yellow band of the post-scutel interrupted. Scutel black.

c. Clypeus yellow, bordered with black below and marked with a black trident.

d. Prothorax black, or only with a little yellow in the middle.

Var. (probable). Posterior margin of the prothorax also bordered with yellow?

I have never seen the males.

Res. a. diff.—This species recalls the European *E. pomiformis* much more than the *E. fraternus*, by its smaller size, by the body being a little velvety, and by its transparent wings, also by its petiole being shorter and more enlarged than in the *E. fraternus*, and at times also divided by a groove. One might ask whether *E. globulosus* may not be a type derived from the European *E. pomiformis*, which may have transmigrated to America.

It differs from the *E. americanus* by having different markings and by its black antennæ; from *E. Iturbide* by its abdomen, which has not the rimmed border on the second segment, and by its differently marked clypeus, for it has all the superior part, especially laterally, marked with yellow, while in the *E. Iturbide*, the yellow upper spot is in the middle, not marginal; the clypeus is also more shining, less strongly punctured, etc.

Hab. The interior of the United States. Illinois, Wisconsin, prairies (6 ♂). Great Slave Lake (British America, ♀).

44. *E. auropilosa* SMITH.—Niger, aureo-pilosus; thorace crasse punctato; clypeo submarginato; antennis subtus ferrugineis; puncto frontali et oculari, macula utrinque et limbo postico pronoti, macula subalari, post-tegulis, linea scutelli et post-scutello maculisque 2 metanoti, flavis; petioli margine et puncto utrinque apicali, segmentorum reliquorum margine, fasciæque laterali utrinque 2ⁱ segmenti cum margine conjuncta, flavis; pedibus rufis basi nigris; alis subhyalinis. ♂—Longit. 4 lin.

E. auropilosa SMITH Cat. Brit. Mus. Vesp., 30, 71.

Hab. Brazil. (Villa Nova.)

*** Second abdominal segment having on each side a yellow fascia, or a complete transverse yellow band on its middle.

45. *E. Cubensis* CRESS.—Fuscus, fulvo, metanoto cæno, pilosus; clypeo emarginato; corpore valde punctato; orbitis, clypeo, macula frontali, margine antico pronoti, macula subalari, maculis 2 mesonoti, tegulis partim scutelli margine antico, post-scutello, metanoto partim, tibiis et tarsis, abdominis petioli apice, fasciæque 2 secundi segmenti, flavis; antennis ferrugineis, basi flavescens, apice nigrescentibus; alis fusco-hyalinis, apice fuliginosis. ♀.—Long. 7 lin.

E. Cubensis CRESSON, Proc. Ent. Soc. of Phila., IV, 1865, 157.

Hab. Cuba. Seems to approach very near to *E. Smithii*.

46. *E. Americanus* SAUSS.—Niger, dense punctatus, ferrugineo-hirtus; petiolo gracili; antennis ferrugineis, apice nigris; pronoto, tegulis, scutelli margine, metanoti et petioli lateribus, ferrugineis; post-scutello, abdominis segmentorum marginibus, secundi fascia utrinque laterali et pedibus, rufa vel aurantiacis; alis subferrugineis.

E. Americanus SAUSS. Vespides, I, 39, 13 (1852).

Total length, 13 mm.; wing, 9 mm.

Form of *E. fraternus*, but smaller and a little more slender. All the body feebly shagreened or rather cribose; the thorax with confluent punctures; not very rough. Clypeus bidentate, yellow, covered with a silvery pile, in both sexes. Thorax short, quadrate. Petiole lengthened, slender, gradually enlarging, insensibly bidentate in the middle, cribose with slightly separated punctures, and bordered at its posterior extremity with a salient cordon, parted by a middle groove. Second segment compressed, flattened beneath, very convex above, densely punctured, and carrying toward the middle of its posterior margin a transverse depression.

Insect black, covered with an abundant ferruginous pile; the black passing much into ferruginous; mandibles ferruginous, black at base; a spot between the antennæ, margin of the notch of the eyes and a line behind them, yellow; the prothorax, wing scale, sides of metathorax, and a spot under the wing, the post-scutel, the anterior border of the scutellum and the sides of the petiole ferruginous or rufous. The second segment ferruginous-brown. The two borders of the prothorax and that of the petiole, in general marked with a yellow edging; post-scutel, a wide border on all the segments of the abdomen, and often two spots on the petiole, orange; the border of the second segment very wide in the middle (not emarginate) being narrower at the sides and often confounding itself with two yellow oblique spots or lines, which occupy the sides of the segment. The abdomen ferruginous beneath; legs ferruginous, with the tibiæ and the tarsi yellow and the thighs above sometimes blackish. Antennæ *ferruginous*, black above on the six last articles. The scape yellow beneath. Wings transparent, with ferruginous nervures, at the end grayish.

♀. Clypeus marked with an orange spot at base and in the middle; its teeth acute.

♂. Clypeus narrower, sulphur-yellow; hook of the antennæ ferruginous.

Var. The whole insect covered with fulvous woolly pubescence. Thorax and petiole rufous; second abd. segment fulvous with a transverse black band produced to the base, separating on each side a yellow macula. Wings obscure, with rufous costa.

Res. a. diff.—This species sometimes offers a resemblance to the *E. globulosus* Sauss., which also has the markings yellow rather than whitish and which is covered with ferruginous hair; but it differs essentially from it in its compressed abdomen, in its petiole, narrow, elongate-pyriform, not campanulate in the middle; in its antennæ ferruginous at the base, etc. It is quite approximate to *E. Smithii*, but smaller; the petiole more slender; the metathorax more triangular; the punctuation of the body not so strong.

Hab. The hot regions of Mexico. I have taken it in the valley of Mextitlan between Mexico and Tampico.

47. *E. Smithii* SAUSS.—Ferrugineus, corpore crasse et densissime punctato, etiam in abd. secundo-segmento; antennis ferrugineis; vertice, mesonoti disco et petioli basi, nigris; postscutello, pronoto et abd. segmentorum 1^o, 2^o, limbo flavis; secundo segmento fusco, fascia transversa rufa vel aurantiaca.

♂. Clypeo argenteo.

Var. Niger, rufo et flavo varius.

Eumenes Smithii SAUSS. Vespides, I, 43, 21; pl. x, fig. 1 (1852).

Total length, 18 mm.; wing, 11 mm.

♀. Of moderate size. In size and in form, resembling *E. fraternus*. Prothorax slightly retracted before; petiole a little longer than in the species cited. Abdomen compressed. The whole insect densely cribose with strong punctures; the second segment of the abdomen a little less coarsely so, but yet strongly cribose. All the body clothed with a grayish pile. Clypeus black, satin-like, notched. Head black; mandibles and antennæ ferruginous; these last obscure above; margin of the eyes and a spot on the front often ferruginous. Thorax red, with the sutures black; the mesothorax at times black with two red stripes and something of black on the flanks and in the furrow of the metathorax. Border of the prothorax, of the wing scale, and the post-scutel often yellow; abdomen black, segments 1, 2 bordered with a yellow cordon; the second marked with a red transverse band; the other segments red, shaded with black at their base.

Feet red or varied with yellow. Wings washed with ferruginous-brown, with golden reflections; the radial cellulae a little brownish.

♂. Clypeus lengthened, bidentate, red or yellow, with a silvery pile; fore part of scape of antennae yellow.

Var. The ground color is often red throughout, and the only black is on the vertex, the disk of mesothorax in part, and the base of petiole. The second segment then has an orange band mingling on its margin with the red or the brown which borders it. It is probable that the highly-colored specimens have the scutellum, the prothorax, and wing scales yellow.

Res. a. diff.—This species is easily recognized by its colors, especially by the transverse band of the second abdominal segment and also by its strong puncturing. It has the abdomen very densely punctured and this character would be sufficient to show its difference from *E. fraternus*, if its markings did not already suffice to distinguish it. It is also very similar to *E. americanus*. Compare this species.

Hab. The Southern United States. Florida. (I possess two males.)

c. Species of uncertain origin.

48. *E. compressus* SAUSS.

Eumenes compressa SAUSS. Vespides, III, 142, 28; pl. viii, fig. 5, 5a (1854).

This species has the form of *E. fraternus*, but the petiole is a little longer, and the 2d segment of the abdomen has no yellow spots.

Its origin is not known.—America?? (Mus. of Paris.)

It would fit next to *E. iturbide*, in the section B, *a*, the wings being rather cloudy iridescent.

Division ZETA.

(SAUSS. Vespides I, 67; III, 132, 146.)

Petiole very long, linear at its base, there depressed and widened *in form of a ribbon*; generally divided upon its dorsal face by a longitudinal groove. The remainder of the abdomen pyriform, compressed at the end; the second segment subpediculate; its base in some degree a short continuation of the petiole.

In this group the mandibles are very long, having indistinct teeth; the head is flattened before; the thorax has a velvety surface. It is wide before and its anterior angles are very distinct. The abdomen is quite lengthened.

This division is more distinct than the preceding, but, nevertheless, it joins itself to Division *Alpha* by the *E. Wagnerianus* and *flavicornis*.

49. *E. abdominalis* DRURY.—Validus, gracilis; corpore velutino; clypeo apice parum emarginato, dentibus rotundatis; petiolo deplanato, sulco partito; alis ferrugineis; antennis ferrugineis, apice supra nigris. (Colorum distributio maxime variat in hoc insecto, a corpore omnino ferrugineo, ad nigro- et flavo-variegatum; varietas maxime abhorrens videtur esse thorace nigro, pronoto et scutellis flavis. Sæpius petiolus niger permanet, margine flavo, et abdomine ferrugineo.) ♀ ♂.

Total length, 21 mm.; wing, 17 mm.

Sphex abdominalis DRURY, *Illust. of Ins.* I, tab. 45, fig. 2 (1770).

Vespa attenuata OLIV. *Encyc. Meth.* VI, 674 (1791).—FABR. *Ent. Syst.* II, 282.

Sphex extensa CHRIST, *Hymen. ibid.* XXXII, fig. 7.

Polistes attenuatus FABR. *S. P.* 279 (1804).

Eumenes abdominalis SAUSS. *Vespides*, I, 70, 58, et in *La Sagra, Hist. de Cuba Ins.* 768.—CRESSON, *Hymen. of Cuba, Proc. Ent. Soc. Philad.* IV, 1865, 157.

Eumenes colona SAUSS. *Vespides*, I, 70, 59 (1852), et in *La Sagra, Hist. de Cuba Ins.* 768, pl. 19, fig. 1.

Eumenes versicolor SAUSS. *ibid.* I, 71, 60.

Eumenes ornatus SAUSS. *Vespides*, III, 147, 35, pl. viii, fig. 3 (1854), et in *La Sagra Hist. de Cuba Ins.* 768.

Eumenes picta SMITH, *Catal. Brit. Mus. Vespidae*, 32, 79 (1857).

♀ ♂. Large. Mandibles forming a long beak by their union, presenting two lines of punctures. Clypeus a little emarginate at its extremity; the notch placed between two rounded projections. Head and thorax punctured, velvety. The angles of prothorax a little salient. Petiole arcuate, shining; of the length of the thorax; divided by a groove. The remainder of the abdomen pyriform, almost fusiform, subvelvety, or even silky. The body clothed with a gray pile.

Antennæ ferruginous, with the extremity of the scape of ♂ ornamented with a yellow line. Mandibles ferruginous. Wings transparent, of a yellow ferruginous along the side. Nothing is more variable than the distribution of the colors on the remainder of the body.

One can arrange the following principal varieties:—

a. Color in the main black; a frontal spot, border of the orbits, an interrupted transverse line before the ocelli and clypeus, yellow; this last marked with a black spot at its summit. Prothorax, a

spot below the wing, scutellum, and post-scutel, extremity of the petiole, a large scalloped border on the second segment and the following segments, yellow. Legs yellow, with the thighs in part black. (*E. ornatus* Sauss.)

Hab. Isle of St. Thomas.

b. Two yellow spots on metathorax. The border of second segment so wide that no black remains but a tricuspid basilar spot. Sometimes there are two yellow smooth spots on the second segment. Two yellow spots appear on the disk of mesothorax. The clypeus and legs are without black, but often present some ferruginous color. (*E. versicolor*.)

Hab. Jamaica. Venezuela.

c. The pyriform part of abdomen ferruginous, with its segments more or less distinctly bordered with yellow. (*E. abdominalis*.)

Hab. Jamaica. Cuba.

There is often a yellow line on the scape of the antennæ and the yellow original markings reappear on the ferruginous color of the thorax. (*E. picta*.)

Hab. Saint Domingo.

d. Thorax almost entirely yellow, presenting only a black spot on the extremity of the disk of the mesothorax, a band before the scutellum, and an oblique one on the flanks. Abdomen ferruginous; the petiole black, bordered with yellow or orange, with the base black and the border yellow. (*E. colona*.)

Hab. Hayti. Jamaica.

e. The whole insect ferruginous, a little varied with yellow on the head and thorax, not offering more of black than the thoracic sutures, and a frontal and vertical line.

Hab. Cuba.

Its form also varies. Specimens which I have taken at St. Thomas are stout; they have the petiole wide; those which I have captured in Jamaica are slender and lithe; their petiole is remarkably narrower.

In conclusion; these variations are not only dependent upon the localities, but probably, also, on the seasons and diverse fortuitous circumstances.

50. *E. canaliculatus* OLIV.

Vespa canaliculata OLIV. Encyc. Meth. VI, 672 (1791).

Vespa diadema FABR. Ent. S. Suppl. 263 (1798); S. P. 285 (*Eumenes*).

Eumenes canaliculata SAUSS. Vesp. I, 68, 56; pl. xi, fig. 5.—DEGEER
Mem. Ins. III, 579, Tab. 29, fig. 3.

Var. a. Wholly ferruginous, with the wings obscure.

b. Abdomen black, with the end ferruginous; petiole ferruginous, with a black margin.

Hab. South America.

51. *E. Orbignyi* SAUSS.

Eumenes Orbignyi SAUSS. Etudes sur la Fam. Vespides, I, 69, 57 (1852).

Hab. Bolivia. Probably a variety of the preceding.

52. *E. Chalicodomæ* n. sp.—Niger; capite et thorace ferrugineis, fronte et mesonoto nigris; tuberculis 2 obsoletis ferrugineis in fronte; clypeo lato, emarginato; abdomine fere impunctato; petiolo mediocri, lævi, vix sulcato, apice puncto impresso et margine flavo; alis infuscatis. ♀.

Total length, 15–20 mm.; wing, 12–16 mm.

♀. Head orbicular, longer than wide. Clypeus large, widely but not deeply emarginate at its inferior border and a little bicarinate; the carinæ distant. Between the antennæ an elongate tubercle parted by a sulcosity, and over this, next to the top of the eyes, two frontal rounded tubercles; vertex arcuate. Thorax elongate, compressed, anteriorly margined by a feeble crest. Scutel convex, parted by a groove; metathorax parted by a channel, nearly to the top. Head and thorax delicately punctate. Disk of mesothorax with two or four sulcosities at base. Petiole moderate, polished, impunctate, as long as the thorax, a little gibbous in the middle; its sulcosity very obsolete; the end without elevated margin, but with an impressed point. The rest of the abdomen elongate, pear-shaped, not compressed, nearly impunctate, except along the edge of the margins; the second edge obsoletely separated from the first.

Head ferruginous; the forehead black, with its three tubercles ferruginous; antennæ ferruginous; the flagellum black above. Thorax ferruginous, beneath and in the grooves of the sides, black; disk of mesothorax black. Abdomen black; the petiole margined with yellow. Feet ferruginous, varied with fuscous. Wings washed with brown; the costa more obscure.

Res. a. diff.—Nearly of the same coloration as *E. canaliculatus*, but smaller; the head less broad, not so triangular, distinct by its two frontal feeble tubercles; the thorax much narrower, more margined anteriorly, more canaliculate posteriorly; the

scutellum not flat nor entire; the petiole shorter, not so distinctly sulcate.—Very distinct from *filiformis* by the same characters and by its nearly impunctate abdomen.

Hab. Brazil. Pernambuco. This insect was bred in a nest of *Chalicodoma*; if as a parasite I could not ascertain.

53. *E. filiformis* SAUSS.—Niger, antennis subtus et abd. apice, ferrugineis; clypeo elongato, flavo-marginato, apice obtuse emarginato, et flavo-bimaculato; thorace brevi, dense punctato, postscutello et metanoto crassius punctatis, petiolo valde elongato, punctato, tenuiter sulcato, pone medium subcoarctato; secundo abd. segmento punctatissimo, rugoso, margine subreflexo; margine postico pronoti, petioli et secundi segmenti, flavis; alis infuscatis, apice subhyalinis. ♀.

E. filiformis SAUSS. Et. Vesp. III, 146, 34, ♀.

Total length, 17 mm.; wing, 13 mm.

Antennæ long and slender. Thorax shorter than that of *E. canaliculatus*, almost globular, squarely cut before, densely punctured; the post-scutellum and the metathorax cribrate with punctures, stronger and less serrate, while in the species cited the thorax is everywhere velvety and finely punctured. The petiole is a little longer than the thorax, very narrow, a little enlarged from before backward, arcuate, flattened, irregularly punctured. Its groove but slightly distinct. The second segment compressed, very *densely shagreened*, appearing rugose above; the punctures much more dense, but not as large as on the metathorax; the first posterior border of this segment slightly turned up and preceded by a transverse depression in the middle; the 2d border narrow, profoundly sunken.

Var. The ornaments of the thorax and of the abdomen are generally of a sombre ferruginous rather than yellow, indistinct; the border of the 2d abdominal segment is sometimes yellow, sometimes ferruginous.

Black, fulvo-velutinous; flagellum of the antennæ beneath, edge of wing scales, knees, and margin of the abdominal segments ferruginous; posterior margin of prothorax and an interrupted fascia at the extremity of the petiole, yellow. Wings washed with brown in the basilar half, subhyaline at the extremity.

♀. Clypeus black, smooth, lengthened, narrow above; its greatest width is in its lower third, carrying two little bosses in the middle (of its height), the terminal border notched at a very

obtuse angle, and forming two slightly diverging salient or obtuse angles.

Two spots at the extremity of clypeus, the lateral margins, and the frontal carina, yellow.

Res. a. diff.—A very distinct species from all the others of this Division by its very punctate compressed abdomen, and by the much impressed edge of the 2d segment, which renders the first edge very sharp. The other species have this edge flat, so that the first edge is hardly distinguishable.

Hab. Brazil. (Author's collections and Spinola's at Turin.)

Gen. **MONTEZUMIA** SAUSS.

Mandibles very long, terminating in a point, channelled, and forming by their union a long beak. *Lip* and jaw very long; *labial palpi* presenting but three articles and often terminated by long hairs.¹ *Maxillary palpi* composed of five articles.

Head normal; generally dilated behind the eyes, and a little concave behind; between the antennæ is a little carina which reaches the clypeus. *Clypeus* ♀ longer than wide, pyriform (that is, rounded at the summit, diminishing downward); emarginate and bidentate; ♂ polygonal, generally as wide as long, and terminated by a nearly straight border placed between two distant side teeth.

Thorax generally lengthened, convex (at times wide) hardly retracted before; prothorax very sharply truncate; metathorax rounded, offering two convex faces, separated by a channel or by a cavity, which are not bordered by sharp, but rounded, effaced edges.

Abdomen generally fusiform; the first segment enlarges

¹ Although the 3d article has a parabolic form, one sees very distinctly that it is the 4th which is wanting, for the 3d preserves at its extremity the long stiff hairs which arm the 3d among the types which have the labial palpi composed of four articles (*Nortonia*). Furthermore, one often discovers that the extremity of the 3d article is formed by a rudiment of the 4th article soldered upon it. This disposition becomes more distinct among the *Monobia*.

gradually, is funnel like, pediculate or sessile, at times campanulate, but when the pedicle exists it only occupies the anterior part of the segment and does not compose the entire segment; it carries above, near the extremity, a longitudinal groove or a rounded excavation.

Most of these insects have an appearance very easy to grasp, thanks to their fusiform abdomen of which the first segment is funnel-shaped. Their principal distinctions are found in this form of the abdomen, combined with the length of the mandibles *and the reduced number of the articles of the palpi*. The mandibles are long and form a beak as with the *Eumenes*, although less sharp; in the females these organs have four teeth or lobules; in the males the inner edge is more entire or with three notches. The clypeus, in general more long than wide in the females, recalls the *Eumenes* also, but its narrow extremity has a triangular notch, separating two triangular teeth; in the males it offers the polygonal form, a quite different type, which by the separation of its terminal teeth has a sort of analogy to the *Zethus*. The head and body are almost equally and always strongly punctured; the abdomen is also wholly punctured, but less strongly. All the body moreover is covered with a velvety pile which often conceals the sculpture. The anterior border of the prothorax is subconcave, but the angles, although at times distinct, are never spinose as with certain *Zethus*.

The form of the abdomen recalls, in the normal types, the form of *Polistes*; it is also fusiform, the 1st segment being funnel shaped, much narrower than the second; but the first segment being larger, and always convex (not completely funnel shaped) suffices always to distinguish this genus, even though the head, with its long mandibles and clypeus, should be wanting. Also the strong puncturing of the thorax and the always short, chubby and wide metathorax assist in marking its differences.

The genus *Montezumia* also includes several types and numerous forms which are slight marks of distinction.

The first segment of the abdomen is often narrow, campanulate and strongly bossed, in such case presenting the form which appears in certain *Odynerus*, having the pediculate abdomen; or, even the thorax becomes wide and flattened; the metathorax

carinate, and hence we have established separate divisions to receive these types.

Let us add that these insects have wholly the appearance of the *Nortonia*, and that one cannot distinguish them but by the dissection of the mouth. If then we separate these two genera, it is that they seem to us to form a deviation from the genus *Odynerus* in two different ways; the *Nortonia* conducting to the *Eumenes*, and the *Montezumia* forming rather a detached ramification which seems more to direct toward the *Polistes* or *Zethus*.

In fine the *Montezumia* have nearly the same buccate organization as the *Monobia*, and are distinguished from these insects by their slender forms; by their abdomen pediculate or fusiform, not distinctly sessile; and by the form of the metathorax, which is convex, divided by a groove, but not excavated as with the *Odynerus*, or which always at least offers two salient enlargements rather than a posterior excavated surface.¹

The genus *Montezumia* is almost exclusively American, but it does not extend into the cold latitudes of this continent. It appears only in Mexico, and extends southward as far as the borders of Patagonia. It has not yet been met with in the United States. It also appears to be limited to the eastern face of the Andes, at least it has not yet been found upon the western side of America.

The habits of these insects remain to this day entirely unknown, although the structure of their mouth does not leave any doubt that they lead a solitary life. Now, however, we may throw some light upon this question, thanks to the kindness of Mr. G. Claraz, who has been willing to send us the nests of *Montezumia ferruginea* described below.

These structures very much resemble the nests of *Pelopæus*. They are of agglutinated masses of earth, in which one finds the cells disposed in a parallel order, in which the insect imprisons

¹ It is true that certain *Montezumia* having the pediculate abdomen offer a sort of concavity of this kind on the metathorax (*M. Lepriurii*, *Huasteca*) but the types with the non-pediculate abdomen, which alone could be confounded with the *Monobia*, have always the metathorax convex, clubbed, and unarmed. Constantly here, as elsewhere, one finds transitory types, but we have allowed that the genus *Monobia* is not entirely decharacterized in the genus *Montezumia* (see the *Monobia egregia* and especially the *Monobia variabilis*).

its prey with the eggs which she has deposited in it. Each one of these lumps contains about ten of the cells. Unfortunately we could not discover what composes the prey of the insect which constructs these, the little cells being found occupied by the nymphs already quite prepared to hatch or even by insects already hatched.

This observation becomes exceedingly interesting by revealing among the solitary wasps a different mode of nidification which is allied to that which one knows among other genera and which recalls the architecture of the *Sphegides*. So we know that the *Eumenes* establish for their offspring separate and distinct cells likewise formed of earth; the *Zethus* build their nests composed of aggregated cellules, established commonly in vegetable matters and fixed upon little branches of trees. The *Odynerus* nidify in holes in walls, in the stems of plants, etc. The *Montezumia*, finally, construct their houses of many rooms, a little like those of *Zethus*, but very much more massively built of earth and stuck against walls or rocks as are those of the *Sphegides* and some of the mason bees.

Division ANTEZUMIA.

Head flattened before (Eumenoide). Abdomen pediculate; the petiole composed of the first segment, of which the first moiety (or the base only) is linear; the second moiety being campanular, not receiving the 2d segment. (Appearance nearly like some *Pachymenes*).

a. Head very flat; clypeus entire; abdomen but little pediculate.

1. *M. chalybea* SAUSS.

Montezumia chalybea SAUSS. Vespides, III, 161, 49; pl. ix, fig. 2, ♀.

Hab. Brazil.

b. Head less flat; clypeus truncate or notched; abdomen more lengthened pediculate.

2. *M. petiolata* SAUSS.

Montezumia petiolata SAUSS. Vespides, III, 161, 50; pl. ix, fig. 1, ♀.

Hab. Brazil.

c. Head less flat; clypeus truncate or notched; petiole rather flattened triangular.

3. *M. brunea* SAUSS.—Velutino-sericea, punctata; clypeo punctato, margine apicali late truncato, biangulato; thorace valde velutino, haud compresso; metanoto brevi, striato, aureo-sericeo; 1^o abd. segmento petiolari, campanulato, apice sulco partito; capite et antennis nigris; his subtus ferrugineis; thorace et petiolo rufis; pronoti margine postico, tegulis, postscutelli maculis 2 petiolique linea marginali, flavescentibus; pronoto, thorace subtus et petiolo ante marginem frequenter fuscis; abdomine fusco-olivaceo; pedibus rufis; alis infumatis, costa fusca.

Variat. Secundo segmento ferrugineo-limbato.

♂. Clypeo lato, sericeo.

Pachymenes brunnea SAUSS. Vesp. I, 76, 4; pl. xii, fig. 6 (1852).

Total length, 16 mm.; wing, 12 mm.

This species has rather the appearance of an *Eumenes*, because of its narrow 1st abdominal segment, campanulate as in *Pachymenes*, but quite flattened, and not bordered at end.

The clypeus ♂ is polygonal, as wide as long, broadly truncate; its inferior margin having a tooth on each side; it is black, silky, with the inferior part yellow.

The body is velutinous; the thorax very much so, rufo-ferruginous with golden reflections; anteriorly blackish; the petiole, broadly club-shaped, parted by a groove, is ferruginous, with the extremity blackish, and the hind margin finely bordered with yellow. The rest of the abdomen brown-olive, with golden reflections. The feet of the color of the thorax.

Ress. a. diff.—It has much the livery of *M. infernalis*, but is very different by the petiolar form of the 1st segment of the abdomen, and by its shorter thorax.

Hab. Cayenne. Venezuela.

Observation.—L. c. I have mentioned that the 2d cubital cell of the wing is triangular in ♀, but this seems to be a mere accident; it is not so in ♂.

Division METAZUMIA.

Head more or less dilated; metathorax convex at summit, a little prolonged and presenting a distinct fossette, but unarmed. Abdomen pyriform, but the first segment retracted, subpediculate at the base, then suddenly *campanulate*; dilated nodulously

above by the meeting of the anterior and superior faces of the segment. The second segment widening toward its base in an ovoid form.

The insects of this division have somewhat the appearance of *Discælius*, on account of the form of their abdomen, but the labial palpi are distinctly composed of three articles only and the maxillary of five.

4. *M. Huasteca* SAUSS. (Fig. 9 ♂, 9a ♀.)—Nigra, nitida, dense punctata; pronoto cristato-marginato; metanoto et abdom. 1^o segmento grosse oribratis; mesonoto et abdom. 2^o segmento tenuiter punctatis; clypeo longiore quam latiore, bidentato striato-punctato; metanoto rotundato, in medio excavato, foveola striata, haud acute marginata instructo; abd. primo segmento angusto, campanulato, supra nodoso inflato; scutelli et postscutelli fascia interrupta, abdominisque segmenti 1'-2' (quandoque 3') margine, fulvis; alis hyalinis costa nigra; antennarum flagello subtus ferrugineo.

♂. Clypeo flavo, antennis uncinatis.

Montezumia huasteca SAUSS. Rev. et Mag. de Zool. 1857, 271.

Total length, 16 mm.; wing, 13 mm.

Appearance of a *Discælius*; clypeus more long than wide, bidentate; the teeth distant, separated by a straight or concave margin; ocelli large, approaching; a deep groove on the vertex. Prothorax strongly rimmed, angulate; scutels flattened, divided by a feeble line, separated by a strong sulcus. Metathorax forming two convex cheeks behind the post-scutel, but its posterior face occupied by an almost round fossette, regularly excavated, shining and striate, slightly punctured, garnished with a gray pile, but without decided border or limiting marks. Lateral ridges effaced. First segment having its anterior fourth pediculate in form and the remainder campanulate, quadrate, nodulously swelled above; (seen in profile this segment has the appearance of carrying a great tubercle, which results from the meeting of the superior with the anterior face at a right angle): this segment less than half the width of the second and offering above a depressed point; second segment rounded, depressed, flat beneath, convex above, enlarging gradually. Head, thorax, and petiole densely punctured; the prominences of the metathorax and the first abdominal segment cribose with large punctures; the mesothorax not strongly punctured; the head punctured,

even striate before; the second and the following abdominal segments densely and finely punctured.

Insect of a shining black; antennæ black, the flagellum ferruginous beneath, both scutels ornamented with a band or with two obscure yellow points. The two, often the three, first segments of the abdomen, equally bordered with a submarginal edging of the same color; that of the first segment continuing itself upon the sides. Legs black. Wings transparent, with the anterior edge blackish.

♀. Clypeus black or more or less tawny or yellow.

Var. End of the abdomen slightly ferruginous; often two tawny dots at the summit of the pro- and of the metathorax.

♂. Clypeus yellow, a little margined with black, strongly bidentate; the teeth sharp, separated by a notch on the arc of a circle. Hook of the antennæ pointed, black or ferruginous. No groove on the vertex.

Res. a. diff.—This species has some resemblance to the *M. sepulchralis* Sauss. Its form is quite like that of *M. Leprieuri*; one might be inclined to take it for a black variety of this species, but the disk of the mesothorax is less strongly and the metathorax less densely punctured in *Huasteca* than in *Leprieuri*.

Hab. The Gulf side of Mexico. I caught several ♀ ♂ near Tampico; some others have been taken near Orizaba.

In this species the third joint of the labial palpi is almost as long as the second and the form distinctly parabolic-pointed; this article is very abruptly terminated and has no appendix. The *maxillary palpi* have their first article dilated; the two following slender and long, the others smaller and smaller.

5. *M. Leprieurii* SPIN.—Nigra; capite, thorace abdominisque primo segmento, valde cribratis; abdomine de reliquo tenuiter punctato; clypeo elongato, bidentato, scutellis, metanoto, abdominis primi segmenti limbo, aurantiacis; alis subinfuscatis, costa nigra.

♂. Clypeo, aurantio; supra et lateraliter nigro-marginato; pronoti margine postico et macula in basi mesonoti disci, aurantiis.

Variat antennis subtus ferrugineis; secundo abdominis segmento, flavo-limbato; reliquis margine piceo. Longit, 0.015.

Odynerus Leprieurii SPINOLA, Ann. Soc. Ent. Fr. X (1841), 127, 78.

Montezumia pelagica SAUSS. Vespides, I, 93, 11, pl. xii, fig. 10, ♀ (1852).

Montezumia Leprieurii SAUSS. Vespides, III, 160.

Hab. Brazil. Cayenne.

Observation.—The specimen described by Spinola has the wings faded, ferruginous.

Division MONTEZUMIA (propr. dict.).

Head dilated. Clypeus truncate or bidentate. Metathorax offering two convex cheeks, unarmed, separated by a furrow. Abdomen fusiform; the first segment funnel-shaped, but enlarged above, capable of retracting more or less of the following one.

In this division the forms are rounder; the first segment is less enlarged above, it does not present a superior and anterior face; it becomes more funnel-shaped and wider, which gives to these insects the appearance of *Polistes* with which they have often been confounded.

1. Abdomen pediculate. The first moiety of the first segment linear.

Division ALPHA.

(SAUSS. Vespides, I, 88; III, 160.)

6. *M. cœrulea* SAUSS. ♀.—Valida, nigro-cœrulea; abdomine cœruleo. clypeo piriformi, punctato, apice submarginato, subbidentato; capite et thorace densissime granulato-punctatis, fulvo-hirtis; metanoti sulco striato; pronoto angulato, cristato-marginato; abdomine fusiformi; tenuiter dense-punctato, primo segmento basi petiolato, in primo dimidio lineari, dein infundibuliformi, in medio subbidentato, supra sulco profundo punctiformi canaliculato; pedibus ferrugineo-sericeis; antennis subtus ferrugineis; alis nigro-cyaneis. Longit, 0.023.

Variat. clypei margine, tarsorum articulo ultimo, scutelli fascia, rufis.

♂. Clypeo truncato; antennis ferrugineis uncinatis.

Montezumia cœrulea SAUSS. Vespides, I, 90, 5; pl. xii, fig. 8, ♀ (1852); III, 160.

M. rubritarsis SAUSS. ibid. I, 90, 4.

M. rufipes SAUSS. ibid. I, 89, 3; pl. xv, fig. 1, ♀ (1852); III, 160.

Odynerus azurescens SPINOL, Mém. Acad. Turin, xiii, 1853, 82, 62, ♂.

Hab. Brazil. Para. Rio Janeiro. Guyana. Cayenne.

7. *M. azureipennis* SAUSS.—*M. cœrulea* simillima, at abdomine nigro; primo segmento sulco parum profundo et utrinque linea angulata flava instructo; alis nigro-cœruleis.

♂. Clypeo rubro, truncato, subbidentato, antennis uncinatis.

Variat ore, tarsis apice, scutellorum fasciis, rufis.

Montezumia azureipennis SAUSS. Vespides, I, 89, 2 (1852); III, 160.

Montezumia rufidentata SAUSS. Vespides, I, 88, 1 (1852).

This insect is most likely a mere variety of *M. cærulea*.

Hab. Brazil. Mexico.

In this section one might nearly place also *M. Ghilianii*, and *M. azteca*. (See below, No. 16 and 18.)

2. First segment of the abdomen subsessile.

Division BETA.

(SAUSS. Vespides, I, 90; III, 162.)

A. *Thorax moderately lengthened, first abdominal segment funnel-shaped, convex, divided by a feeble groove, vertex somewhat swollen.*

a. *Wings transparent or ferruginous.*

8. *M. nigriceps* SPIN.—Niger; abdominis 1^o segmento infundibuliformi, brevissime petiolato, latitudine $\frac{3}{4}$ secundi; mandibulis ferrugineis; thorace et pedibus rufis; illo paulo nigro-vario; post-scutello flavo-binotato; abdominis primo segmento basi rufo, anguste flavo-limbato; alis hyalinis, venis testaceis.

♂. Clypeo polygonale, albido, margine antico truncato, integro; antennis apice uncinato obtuso testaceo instructis. Long. 5–6 lin.

Eumenes? nigriceps SPINOLA, Ins. rec. à Cayenne par Leprieur, Ann. Ent.

Fr. X, 1841, 128, 79, ♂.

Montezumia nigriceps SAUSS. Vespides, III, 162, 51.

Hab. Cayenne.

9. *M. infundibuliformis* FABR.—Gracilis, clypeo piriformi, truncato, punctato-striato; corpore punctato; pronoto marginato, angulato; mesonoto nitido, sparse punctato; metanoto dense punctato, velutino, hirto, in medio tantum canaliculato; capite, thorace et pedibus nigris, tomento aureo rariore sericeis; abdomine ferrugineo, vel badio; primo segmento infundibuliformi, fasciis 2 nigris et utrinque dente laterali instructo; segmentis 3–5 punctatis; tarsis apice rufis; mandibulis ferrugineo-variis; antennis subtus obscure ferrugineis; alis hyalinis, venis nigris.

Var. Segmentis 1^o, 2^o limbo flavescente; tarsis et tibiis fuscescentibus. Longit, 18 mm.

♀. Clypeo apice truncato vel submarginato, infero ferrugineo vel albido marginato.

♂. Clypeo truncato, frequenter albido-marginato.

Eumenes infundibuliformis FABR. Syst. Piez, 288, 14 (1804).

Montezumia dimidiata SAUSS. Vespides, I, 91, 13 (1852); (Syn. Olivieri exelus), ibid. III, 160.

Hab. Brazil. (Author's collection.)

This species has a remarkable resemblance to *Polybia* because of its hyaline wings. It must not be confounded with *Polybia dimidiata* Ol., or *Polistes bicolor* Sss.

10. M. Cortesiana SAUSS.—Carbonaria, velutina, nigro-fulvo hirta, purpureo-sericea; clypeo punctato, apice truncato, subexciso; capite densissime punctato; pronoto, post-scutello et metanoto densissime grosse punctatis; mesonoti disco et scutello sparse, abdomine tenuiter, punctatis; pronoto angulato, cristato-marginato; abdominis primo segmento elongato-campanulari, supra sulco foveolato; tarsis anticis apice, elypei marginibus lateralibus et mandibularum margine interno, rufis; antennis ferrugineis, basi nigris; alis pallide flavo-griseis, venis anticis fusco-ferrugineis. ♀. Longit. 0.020 m.

Montezumia Cortesia SAUSS. Vespides, I, 92, 10, ♀; pl. xv, fig. 2, ♀ (1852).

Hab. Mexico. (Typus in auctoris museo.)

11. M. sepulchralis SAUSS. ♂.—Præcedentis statura et facie, illi simillima; clypeo et mandibulis nigris, vel clypeo utrinque puncto rufo; primo segmento obscure ferrugineo-limbato; alis ferrugineis. (Anne præcedentis varietas?.)

Montezumia sepulchralis SAUSS. Vespides, III, 163, 54 (1854).

Montezumia mortuorum SAUSS. Vespides, III, 164, 55 (1854).

Hab. South America.

12. M. analis SAUSS.

Montezumia analis SAUSS. Vespides, III, 163, 53.

Hab. South America.

b. Wings obscure, smoky, fuscous or black.

* Body more or less ferruginous.

13. M. Spinolæ SAUSS.—Sat gracilis, omnino velutina; capite et thorace dense punctatis; metathorace crassissime rugato, late plane foveolato; scutellis convexis, sulco longitudinali divisis; antennis,

capite, mesonoto, abdominis segmentis 20-70, nigris; pedibus, pronoto, scutellis tegulis et pleuris, metanoto et abdominis 10 segmento, rufis, aureo-velutinis; frequenter pronoti margine postico, tegulis partim, metanoti maculis 2 et canthis, primique segmenti margine, flavis; alis fusco-violascentibus, costa nigra, apice pallidiore.

♂. Clypeo punctulato polygonali, fere latiore quam longiore, late exciso; macula genarum flava; antennarum uncino et scapo subtus, ferrugineis.

Variat. a. Clypeo flavo-maculato.

b. Abdomine omnino nigrescente, apice fere ferrugineo.

c. Mesonoti disco ferrugineo-bilineato; 10 abd. segmento fascia flava interrupta.

Montezumia Spinolæ SAUSS. Et. Vesp. I, 93, 12; pl. xii, fig. 9, ♀ var. (1852).

Odynerus infernalis SPINOLA, Mém. Acad. Turin, XIII, 1853, 84, 64, ♂.

Montezumia infernalis SAUSS. Et. Vespides, III, 162, 52.

Total length, 16-18 mm.; wing, 14-15 mm.

Strongly and densely punctured. Front a little channelled transversely above the antennæ, vertex a little swelled behind in a transverse pad. Prothorax angulate, truncate before, following a slightly concave trenchant line. Clypeus and post-scutel divided by a groove. Metathorax short, vertically wide, rugose, punctured and velvety; its concavity almost in the form of an angle, plane, a little bordered at summit. First abdominal segment campanular subsessile, finely punctured, with a groove above toward the extremity. The 2d segment notably more enlarged, with scarce punctures clothed with a velvety pile, as if striolate. The other segments densely and finely punctured.

Black; labrum very long, ferruginous; a little yellow line bordering the eyes below and another upon the scape of the antennæ, ♂. Thorax of a velvety ferruginous; disk of the mesothorax black; prothorax and flanks brownish, with the borders of the first and some spots on the second reddish; wing scales spotted with yellow; post-scutel adorned with a yellow line; metathorax having some silky golden-yellow reflections and two yellow spots upon the summit. First segment red, with a yellow border. Legs ferruginous, with golden reflections. Wings of a black violaceous, with the extremity more pale. (Surinam.)

The color of the thorax varies very much, from ferruginous to obscure brownish. The border of prothorax and the sides of the thorax under the wing, ornamented with yellow.

♂. Clypeus rather convex at the top, flattened below, terminated by two distant teeth, separated by a straight border; its color obscure like that of the head, or having in its inferior part a yellow mark or triangle.

Var. a. Clypeus and antennæ entirely black, without yellow.

b. Thorax entirely ferruginous except the disk of the mesonotum, which is blackish.

c. The first segment of abdomen blackish (*Spinolæ*, Sss.).

d. The first segment ferruginous, margined with yellowish; the yellow fascia preceded by a fuscous stain.

Res. a. diff.—I have joined *M. infernalis* to *Spinolæ*, for it is very likely to be the same species. These velvety, partly ferruginous insects are so variable that only the examination of numerous specimens can settle the entomologist as to the value of the species. Compare this species with *M. Ghilianii*, *Mexicana*, and *ferruginea*.

Hab. Brazil, Para; Surinam. (Type of *Spinola* in Turin museum; the author's type in his own collection.)

Observation.—The name *M. infernalis* was given by my excellent friend Marquis Max. Spinola before I gave the species the name of *Spinolæ*, but the manuscript of *Spinola* having taken a long time to print, the name *Spinolæ* was published first, so that I was obliged to preserve it.

14. *M. Ghilianii* n. sp.—Velutina, nigrescens vel fusca; metanoto, scutellis, pedibus et abdominis primo segmento, rufis; hoc flavo-marginato; thorace lato; abdominis primo segmento depresso, subpetiolato.

Total length, 18 mm.; wing, 15 mm.

Size and livery as in *M. Spinolæ*, but the thorax much wider, dilated, and the prothorax not quite so angular. The scutel and post-scutel not parted by a longitudinal groove, but rather by a sort of indication of a carina. The metathorax shorter than in the said species, less chubby, more angular. The first abdominal segment a little more petiolate; its dilatation shorter, depressed, not so convex, bell-shaped.

Body quite velvety, covered with golden hair. Head black; antennæ ferruginous beneath. Thorax black; hind margins of prothorax bordered by a rufous line; tegulæ, scutels, metathorax, legs, and various spots under the wings rufo-ferruginous. Abdo-

men blackish; the first segment rufous, margined with yellow and blackish before the yellow band. Wings brownish, dark along the costa.

♂. Clypeus black, terminated by two distant teeth as in the other species.

Res. a. diff.—This certainly very variable species is quite similar to *M. Spinolæ* in its size and livery, but the thorax is not so slender, the head is more inflated, the 1st segment more flattened. It has nearly the *facies* of a *Pachymenes* because of the exceptionally depressed form of this segment, which forms nearly a campanular petiole.

Hab. Brazil.

I have described the specimen in the Turin museum; it is also a species of the rich collection of Spinola.

15. *M. Mexicana* SAUSS. (Fig. 11.)—Obscure ferruginea; alis dilute fuscis; capite et thorace valde punctatis; clypeo bidentato; pronoto haud angulato scutellis sulco partitis; post-scutello carinato-crenulado, flavo; metanoto rugoso, per sulcum vel foveolam haud marginatam diviso; abdomine sericeo; primo segmento infundibuliformi, apicem versus linea impressa notato; alis infuscatis, cyanescentibus. ♀.

Variat. Omnino ferruginea, alis fuscescentibus.

Montezuma Mexicana SAUSS. *Vespides*, I, 94, 14 (1852).

Total length, 20 mm.; wing, 15 mm.

♀. Insect slender. Head and thorax densely cribose, shagreened, rugose. Clypeus pyriform, convex, strongly punctured, terminated by two little subcontiguous teeth. Between the antennæ is a little carina in form of a T. Thorax lengthened; prothorax slightly retracted anteriorly, very finely rimmed, not angulate. Scutellum and post-scutel divided by a longitudinal groove; the post-scutel separated from the scutellum by a deep furrow and forming a ridge, transverse, crenulate, divided by the medial groove. Metathorax offering two convex cheeks much more rugose than the remainder of the thorax, divided by a striate fossette, which has no distinct margin; the lateral ridges effaced by the rugosities. Abdomen smooth, shining, sericeous, or velvety; the first segment at the base subsessile, then funnel-shaped, convex, having a lengthened depression above; the second segment moderately larger than the first, its border a little upturned. The abdomen finely punctured beneath its velvety pile.

Insect ferruginous. The thorax often varied with black in the sutures and upon the mesothorax. Antennæ ferruginous, with the flagellum blackish above, beyond the third article; post-scutel orange; (probably often also the wing scale, the posterior border of the prothorax and that of the first two abdominal segments sometimes of the same color; the yellow border of the first segment, when it exists, is often interrupted.) Legs ferruginous; wings brown, slightly darkened, with violet and golden reflections.

Var. The thorax is sometimes less lengthened than in the type.

Res. a. diff.—I think this species nearly related to *M. ferruginea* Sauss., which does not appear to have violet wings. It is near to *Mexicana*, but the abdomen of this last is a little pediculate and the head more swollen. It is also closely related to *M. Spinolæ*, but it differs from it by its thorax without angles, with little margin, by its metathorax slightly attenuate, less truncate vertically, less excavated, more rounded, less quadrate. It is very similar also to *M. infernalis* Sp., with which I cannot compare it, the sexes not being the same in the two types; the metathorax is more rugose in *Mexicana* ♀, and not so excavated. It resembles also the *Nortonia tolteca*, but is perfectly distinct from it by its lengthened thorax, as high as wide and not depressed and widened; by its violet wings, by its strongly divided scutels, by its crenulate post-scutel, etc.

Hab. The gulf side of Mexico. I have found a female near Tampico.

16. *M. ferruginea* SAUSS.—Gracillima, ferruginea dense punctata, subvelutina; capite pone oculos producto; paulo altiore quam latiore; thorace valde elongato, compresso, angusto, metanoto postice producto, sulco profundo diviso; abdomine gracili; primo segmento elongato, depresso; sulco valde impresso partito; antennarum flagello superne vel omnino nigro; clypeo et capite flavis, vertice ferrugineo-notato; abdominis segmentorum marginibus lituris subinterruptis flavis ornatis; alis infuscatis purpureo-nitentibus, costa, præcipue in apice, ferruginea. Longit, 19 mm.

♀. Clypeo piriformi, apice bispinoso; mandibulis crenulatis.

Variat. Omnino ferruginea, seu pedibus flavo-variis, vel thoracis suturis nigris.

Montezumia ferruginea SAUSS. Vespides, I, 91, 7 (1852).

Hab. South America. Uruguay. La Plata. Patagonia 1 ♀. (G. Claraz.)

This is a distinct species, remarkable by its slender body. Its nidification has been indicated before in the description of the genus.

**** Body quite black.**

17. *M. morosa* SAUSS.—Nigro-cinerea; capite et thorace dense punctatis; pronoto tenuiter marginato; scutelli parte postica et post-scutello sulco partitis; metanoto haud attenuato, valde excavato, argenteo-hirto, utrinque convexo, rugato; aldomine dense punctulato, cinereo sericeo; pedibus anticis partim, mandibulis, clypeo antennarumque scapo subtus obscure ferrugineis; alis fusco-violaceis costa obscuriore. Long., 18–22 mm.

♀. Clypeo late piriformi, apice dentulis 2 invicem propinquis instructo.

♂. Clypeo breviori, longitudine latitudini subæquali, late emarginato dentibus 2 invicem distantibus instructo; antennarum uncino rufo.

Montezumia morosa SAUSS. *Vespides*, I, 90, 6 (1852).

This species is characterized by its black body, with gray-silky changes, but without violet-green reflections. The wings are more or less obscure, with more or less of violet changes. The metathorax is rather broad, not attenuated; the prothorax not much angulated. The abdomen is subsessile, the first segment bell-shaped with a little groove on its superior side.

A male specimen from Mexico, which I cannot separate from this species, has the thorax a little larger than the specimens from South America.

The inner edge of the mandibles of the male is not lobed nor indented, but only a little unequal.

Hab. The eastern part of South America. Brazil. Guyana. Mexico. (I caught a male on the eastern coast of the gulf, near San-Andrés-Tuxtla.)

18. *M. Marthæ* n. sp.—Nigra; post-scutello, metathorace abdominisque 10 segmento basi sulfureis; alis fusco-violascentibus. ♀.

Total length, 17 mm.; wing, 15 mm.

♀. Head and thorax much as in *M. morosa*. Clypeus covered with longitudinal punctures; its inferior end formed by two little teeth separated by a straight border. Head and thorax very densely shagreened; metathorax short, much rounded. Abdomen very finely punctured, not so regularly fusiform as in *morosa*; the first segment somewhat narrower compared with the second

one, but having the same form as in *morosa* and marked with a subapical sulcosity.

Insect black, furnished with a short grayish pubescence. Post-scutel, metathorax, and first abdominal segment sulphur-yellow; the latter margined with a black band. Tarsi furnished with a golden-silky pile having a brownish reflection; tibial spines rufous. Wings dark fuscous with dark violet iridescence; the apex paler.

Hab. Santa-Martha. Antilles.

19. *M. Platensis.*

Montezumia platina SAUSS. Vesp., I, 92, 9; pl. xv, fig. 3, ♀.

Hab. La Plata.

20. *M. anceps* SAUSS.—*M. morosæ* affinis, at corpore paulo magis tenuiter punctato; clypeo longiore, minus rugoso, apice truncato, biangulato; thorace paulo brevior; pronoto angulato; mesonoto brevior, metanoto minus obliquo; alis apice et postice pellucidis, basi et in costa nigris. ♀.

Variat. Primo segmento utrinque lineola submarginali fulva.

Total length, 15 mm.; wing, 12 mm.

Montezumia anceps SAUSS. Vespides, I, 92, 8 (1852).

Much resembles *M. morosa*, but in this the clypeus is in form of a short and wide pear and terminates in a point, parted by a little notch; in *M. anceps* it is more lengthened, truncate, and bicarinate, the carinæ forming a tooth on each side of the little inferior border. The wings are hyaline with the costa up to the stigma dark-brown, this color very soon becoming faint; the second cubital cell is also less contracted in *M. anceps*, which is also a smaller species.

Hab. South America. Rio Janeiro.

21. *M. Azteca* n. sp. (Fig. 10, 10a.)—Viridi-cærulea, cinereo-sericea; capite et thorace valde punctatis; abdomine punctulato, nigro; alis fusco-violaceis.

♂. Clypeo infere fulvo-binotato, margine truncato subbidentato; antennarum articulo ultimo deplanato, ferrugineo.

Total length, 20 mm.; wing, 14 mm.

♂. Head short, the width of thorax. Thorax long, neither retracted before nor behind. Prothorax sharply truncate, rimmed,

with the angles rather sharp. Metathorax quite rounded, offering two large dilated cheeks, strongly separated by a wide channel; the lateral ridges effaced, rounded. Abdomen having the same form as in *M. cœrulea*, funnel-shaped, but its petiole much shorter, forming hardly the third or the fourth of the first segment; this retracts the second as in the *Polistes*, and carries a distinct groove above; the second segment having its border insensibly subreflexed. Head and thorax very densely and coarsely punctured throughout, of an elegant bluish-green violet, having metallic reflections and garnished with a whitish pile, especially distinct on the metathorax. Abdomen shining, black, with some iridescent reflections; densely punctured, but with a silky pile, of gray hairs. Legs black; the anterior tarsi at times ferruginous. Wings brownish, with violet reflections; the anterior edge darker.

♂. Clypeus polygonal, widely truncated, covered with a silvery pile, offering toward the bottom two little arcuate carinæ, which end at the two distant teeth, limiting each side of the anterior margin. The color of clypeus is bluish, like that of the head, but it is marked on its anterior border with a double, pale, orange spot; the margin delicately black. Antennæ black, rolled spirally at the extremity, with the last article flattened, obtuse, and ferruginous. Mandibles almost without teeth, offering only some feeble notches.

Res. a. diff.—This species approaches the *M. morosa*, although it is easily distinguished from it by the blue, not black, color of the thorax and the head, its punctures are larger, not so dense; the metathorax is more channelled and not so excavated; the scutellum more flattened and parted in its length by a delicate groove. The first abdominal segment is less dilated above; its base is linear, pediculate for the length of a half line or less, while with the *M. morosa* this segment is more sessile.

One might confound it also with *M. cœrulescens*, of which it has much the appearance, except that its petiole is much shorter.

Hab. The gulf side of Mexico. I have taken but one specimen near Tampico.

Observation.—This species is quite intermediate between Sect. 1st and Sect. 2d, its abdomen being rather pediculate.

B. *Head strongly dilated on the vertex behind the eyes, having (so to speak) an anomalous form. Thorax much lengthened: abdomen often large. The first segment depressed or flattened above and divided by a very distinct groove.*

22. M. Brasiliensis SAUSS. ♂.—*Præcedentium staturæ vel paulo major; occipite maxime producto, thorace eodemmodo elongato, sed antice magis rotundato et metanoto paulo latiore, truncatiore, foveolato; abdomine latiore, segmentis, 1^o, 2^o, depressis; primo lato, sulco profundo diviso. Insecti color omnino castaneus; metanoto, lateribus et antennarum flagello, nigris. Alis fusco-cyaneis, stigmatibus ferrugineo.* Longit, 19 mm.

Variat: Pedibus flavo-varis; abdominis primo segmento flavo-marginato; corpore plus minusve ferrugineo.

♂. *Antennis apice uncino parvulo fulvo instructis; clypeo ferrugineo apice emarginato, valde bidentato.*

Montezumia Brasiliensis SAUSS. Vespides, III, 164, 56 (1854).

Hab. Brazil. Province of the mines. (Typus in museo Parisiensi.)

23. M. macrocephala SAUSS.

Montezumia macrocephala SAUSS. Vespides, III, 165,¹ 57; pl. iv, fig. 3, ♂ (1854).

Abdomine maxime dilatato.

In this species the male has the abdomen squat or flattened, strongly dilated and depressed; its first segment is parted by a strong groove, sometimes continued on the 2d segment. In the female the abdomen is not so flattened down but is slender and of the normal form. The clypeus ♀ is terminated by two small, rather distant teeth.

Var. Often the clypeus ♀, the face, tarsi, and margins of the abdominal segments become yellowish. On the contrary, the whole insect often becomes uniformly ferruginous.

Hab. Brazil. (The type in the Paris museum.)

Division PARAZUMIA.

(SAUSS. Vespides, III, 166.)

Head much dilated behind the eyes; thorax wide and strongly depressed; metathorax prolonged behind obliquely; its lateral

¹ *Errata.*—10th line of the description, instead of "*dessous des antennes*," read: "*dessus des antennes*."

ridges very sharp. Abdomen sessile, depressed; the first segment wide, sessile, funnel-shaped.

24. *M. carinulata* SPIN.—Niger, mandibulis, tarsis et abdomine ferrugineis; corpore polito, fulvo-sericeo; capite nigro, vertex impressione post-oculari notato; clypeo biangulato, angulis rufis et utrinque supra angulos dentulo instructo; thorace depresso, latiore quam abdomen, superne convexo, polito; scutello post-scutelloque deplanatis, hoc postice angulato, haud truncato, per metanotum involutum; metathorace superne convexo, utrinque cantho laterali acuto, in medio incisura elongato-quadrata strigataque exarato; ejus marginibus acutis, tenuiter flavis; abdomine gracili, primo segmento elongato-piriformi, superne carinula longitudinali partito; alis hyalinis, succineo-subinquinatis, venis fuscis. ♀.

Odynerus carinulatus SPINOLA! Acad. de Turin, XIII, 1853, 83, 63.

Montezumia carinulata SAUSS. Vespides, III, 166, 58, ♀ (nec ♂).

Total length, 16 mm.; wing, 14 mm.

In this species the clypeus is terminated by a little margin, truncate, with the angles rather salient, but there is somewhat higher, a sort of depression imitating a false truncature, forming also on each side a little tooth-like eminence. The thorax is wide, depressed, very large if compared to the slender abdomen. Its upper surface forms a sort of flattened vault, without gibbosities; the scutel and post-scutel are flattened, making the continuation of this vault with the upper face of metathorax, which is not to be distinguished from the posterior face. The latter is canaliculate with a sort of square notch, bordered with sharp ridges.

The body is not velvety, but much polished, although garnished with fulvous hair. (Type of Spinolæ.)

Hab. Brazil. *Para.* (Typus in musco Spinolæ, Taurinis.)

DIVISION PSEUDOZUMIA.

Body depressed. Thorax wide; lateral ridges of metathorax distinct. First segment of abdomen in the form of a lengthened triangle, flattened and longitudinally striate.

Insects Asiatic.

M. indica SAUSS. Vespides, III, 167; pl. ix, fig. 4.—India.

Gen. **MONOBIA** SA

Lip moderate. Labial palpi composed of three or four articles, the fourth rudimentary and soldered when it exists. *Maxillary palpi* composed of five articles.

Mandibles lengthened, channelled, lobulate toward the end on the inner border and terminating in a point as in the *Odynerus*.

Metathorax excavated. *Abdomen* sessile, conical or ovoid, not fusiform.

The *Monobia* are *Odynerina* among which the number of articles of the palpi is diminished and which for this reason approach the *Montezumia* and *Synagris*. Their bodies offer different forms, peculiarly varied like the *Odynerina*, such as: metathorax rounded, or marginate or bidentate, the abdomen more or less conic or even rather ovoid, etc.

The buccal organization of the *Monobia* is evidently the same as with the *Montezumia*; however, the labial palpi are more variable, and one sees in these organs the rudiments of the 4th article more clearly developed.

The *Monobia* differ from the *Montezumia* by their wide and excavated metathorax and by their abdomen, conical or at least sessile and not pediculate nor fusiform. Yet here also one meets intermediate types which form the transition from one genus to the other; (see the *Monobia egregia* and *variabilis*.)

Nevertheless the greater number of species have wholly the forms of the *Odynerus* and cannot be distinguished from this genus but by the dissection of the mouth.

Division I.¹

Labial palpi composed of three article, the 3d elongate.

A. *Metathorax bispinose*.

1. M. Californica SAUSS.—Gracilis, ferruginea, sparse punctata; metanoto foveolato, utrinque spinoso; antennis superne ultra medium nigrescentibus; macula frontali flava; vertice nigro, fascia arcuata et

¹ Perhaps this division should not be separated from the second, but not having the insects before my eyes, it is impossible for me to decide.

orbitis ferrugineis; mesonoti disco nigro, signaturis 2 rufis; abdominis segmentis basi nigris; pronoti et abdominis segmentorum 1-2 margine, tegulis, scutellis, tibiis et tarsis, flavis; alis fumosis.

Montezumia Californica SAUSS. Revue de Zool., xv, 1863.

Total length, 18 mm.; wing, 13 mm.

♂. The slender and lengthened form of *Montezumia*, but the abdomen more truncate at its base. Head rather small. Thorax very little retracted before or behind; metathorax squarely cut, scarcely prolonged behind the post-scutel; its posterior face truncate, excavated in almost all its width, occupied by a vertical furrow, smooth and shining, slightly striate from the middle downward; armed on each side with a strong spiniform tooth; the inferior borders of the concavity quite trenchant, but the superior, situated above the spines, completely rounded and effaced. Scutellum and post-scutel separated by a deep groove and divided by a longitudinal groove; the post-scutel rather carinated. Head and thorax smooth, covered with finely punctured spots, the metathorax more strongly punctured. Abdomen lengthened, but subsessile; the first segment wide, rounded-truncate at its base, but still less wide than the 2d, which is longer than wide. All the segments having their posterior border divided by a little longitudinal groove.

Insect of a bay-ferruginous, with satin-like, slightly glaucous reflections. Clypeus (♂) convex, polygonal, a little notched in the arc of a circle and armed with two angular teeth. Front and vertex black, but a spot above the insertion of the antennæ yellow. A space behind the eyes and the complete border of the orbits orange-ferruginous; the two lines which border the summit of the eyes unite on the posterior part of the vertex, forming a horseshoe. Mouth and antennæ ferruginous; these last a little obscure above in their second moiety and nearly to the end. Thorax varied with black beneath and along its sutural lines; disk of the mesothorax black, with a double ferruginous spot; a little black at the bottom of the concavity of the metathorax and at the base of the abdominal segments. Wing scales, post-scutel, and margin of the first two abdominal segments, yellow; the border of the second a little festooned and narrow in the middle; the border of prothorax and of the other segments also a little yellow. Legs ferruginous, with the tibiæ and tarsi yellowish. Wings smoky, with slight violet reflections.

This doubtless varies much. Its yellow markings are probably often more developed and the body partly encroached upon by black.

Res. a. diff.—This species is remarkable from its slender form and its metathorax puffed or chubby at the summit. By this character it establishes itself in the genus *Monobia* and marks the transition from the *Montezumia*.

In its colors it recalls certain *Odyneri* of the old world (*O. multicolor* and allies), and also certain *Odyneri* of its own country, such as the *O. annulatus*, *pratensis*, and in fine some Mexican species, such as the *O. Iturbide*. But it differs from all—1st, by its abdomen lengthened, not conical; 2d, by its metathorax which is chubby at its summit on each side of the post-scutel, because that is a little prolonged behind; 3d, by its labial palpi distinctly composed of only three articles and the maxillary clearly of five.

It differs from the *M. egregia* by its metathorax, chubby at the summit and truncate, not in a line with the post-scutel, but more behind; having a smaller concavity and of another form, more inclosed, and of which the spiniform angles are placed above the middle.

It approaches more to the *M. variabilis* in its form, but is more slender, and the body is not strongly cribose nor velvety, as with this species, but smooth, satin-like, with glaucous reflections.

Hab. Lower California. Taken at Cape St. Lucas by T. Xantus.

Observation.—With this species the buccal organs are but little lengthened; the tongue, the galea, and the maxillary palpi are quite short; the labial palpi are slender, the articles long.

2. *M. cyanipennis* GUER.

Odynerus cyanipennis GUER. Voy. de la Coquille, Ins., 264; pl. ix, fig. 5, ♂ (1830).

Monobia cyanipennis SAUSS. Vespides, I, 96, 2.

Hab. Chili. (Typus in mus. Dom. Guerin Méneville.)

B. *Metathorax* not bispinose.a. *Metathorax* with rough angles.

3. *M. silvatica* SAUSS.—Nigra, punctata; clypeo apice truncato; metatho:acis canthis rugosis haud acutis; abdomine sessili, basi truncato, primo segmento secundo æquilato, secundi margine subcanaliculato et valde punctato; mandibulis, macula, frontali et post-oculari, clypeo, antennis basi, pronoto, tegulis maculisque 2 scutelli, ferrugineis; abd. 1^o segmento repande flavo-limbato; pedibus flavis, basi nigris; alis fusco-violascentibus. ♀.

Variat. Corpore plus minusve flavo-variegato.

Monobia sylvatica SAUSS. Vespides I, 95, 1; pl. xv, fig. 7, ♀.

Hab. Brazil. (Typus in mus. Parisiense.)

This insect closely resembles *Rhynchium* (*Odynerus*) *dorsale*, but it is somewhat smaller. The species seems to be distinct from this, and I made some confusion with it in my Vespides III, p. 168.—Compare *Odyn. dorsalis*, page 260, *Obs.*

b. *Metathorax* rounded, unarmed.4. *M. anomala* SAUSS.

Monobia anomala SAUSS. Vespides, I, 96, 3; pl. xv, fig. 4 (1852).

Hab. Brazil. (Typus in mus. Dom. Guérin Méneville.)

Division II.

Labial palpi composed of three articles; the 3d carrying at its extremity a 4th rudimentary article, soldered to the 3d, difficult to distinguish, embodied with it, and armed with stiff hairs like the extremity of the 3d.

A. *Abdomen* conical; the first segment wide and truncate.
Hinder portion of the metathorax bordered by trenchant ridges and armed on each side with a dentiform angle.

This type establishes the transition to *Odynerus* from the subgenus *Odynerus*, properly called, to *Rhynchium*, by its quadrate thorax and its conical abdomen.

5. *M. quadridens* Linn.—Valida, nigra, capite et thorace valde punctatis; clypeo piriformi, apice ♂ bidentato, ♀ biangulato; abdomine conico; pronoti maculis 2, post-scutello et abd. primo segmento supra, albidis; ♂ minor, clypeo albido.

Vespa 4-dens LINN. Syst. Nat. II, 95, 15 (1767).—AMEN Acad. VI, 413.—

MUELLER, Ed. Lin. II, 881, 15.—CHRIST Hymen., 234.—ILLIGER, Comp. Ins. rarior., 30, 92.

Vespa uncinata FABR. Syst. Ent., 367, 22 (1775).—Syst. Piez., 259, 31.¹

OLIV. Encycl., VI, 685.

Vespa cincta-nigra DEGEER. Mem. Ins. III, 583, 8; tab. xxix, fig. 12.

Odynerus uncinatus LEP. St. Farg. Hym., II, 619, 9.

Odynerus quadridens SAY, Bost. Journ., I, 386, 3; Ed. LE COQTE, II, 766, 3.

Monobia quadridens SACSS. Vespides, I, 97, 4; III, 168.

Monobia uncinata SACSS. Ibid. I; pl. xvi, fig. 1 (bad figure).

Total length, 20 mm.; wing, 17 mm.

Large. Head densely punctured, often presenting on the vertex a little depression. Thorax densely punctured; prothorax with a slender margin; mesothorax offering above the scutellum two distinct grooves; scutellum feebly convex, but little divided, post-scutel subdivided, not crenulate; metathorax slightly retracted, offering on its posterior face a subconcave furrow, very finely striate, distinctly margined (at least at bottom) and armed on each side with a spine. (The upper ridges are often a little effaced by the punctures.) Abdomen smooth, ovalo-conical, covered with fine scattered punctures; the first segment perfectly sessile, truncated before, punctured on its anterior face, as wide as the 2d and divided by a groove on its upper face; the 2d quite strongly punctured with separated points, more and more dense toward the posterior border.

Insect black, shining; two great spots on the prothorax, the post-scutel and the first segment of the abdomen above, whitish. Wings of a black violet.

♀. Clypeus black, pyriform, punctured, terminated by two dentiform, diverging, carinated angles.

♂. Clypeus whitish, margined with black, terminated by two separated teeth, divided by a wide slightly concave border. Antennæ terminated by a hook.

¹ The description of Linnéus is incomplete, that of Fabricius touched with error, and the name has two typographical faults in the Syst. Piez. Yet there can be no doubt regarding the species. Linné has counted as teeth the two angles at *bottom of metathorax* which receive the articulation of the abdomen. Fabricius does not notice the metathoracic teeth, doubtless because the abdomen, raised and pressed against it, concealed them from his sight.

Var. Scutel and metathorax with two whitish spots.

Res. a. diff.—The *Monobia 4-dens* is very difficult to distinguish from the *Odynerus bidens*; however, one can always recognize it—1st, by its clypeus armed with two teeth ♂, with two salient angles ♀; 2d, by its abdomen, punctured more strongly and throughout, especially on the anterior face of the first segment and upon the second which does not offer an arcuate band of strong punctures along its border; 3d, by its maxillary palpi which have but five articles and the labial having the 4th article rudimentary and soldered upon the third. Compare also *Odynerus quadrisectus*.

Hab. The United States. A species common in all the eastern part of the country.

I possess a great number of specimens taken in all the Eastern States, in New England (Norton), in Illinois (Walch, Kennicott), in Tennessee (Freudenreich-Falconnet, Fuchs), in South Carolina, Louisiana (author), Florida (Norton).

B. Abdomen ovalo-conical; the first segment more rounded, less truncate, less sessile. Metathorax rounded; its concavity not bordered above by trenchant ridges.

a. On each side of metathorax a dentiform angle.

6. *M. angulosa* SAUSS.—Valida, nigra, punctata; clypeo ♀ piriformi, punctato, infere striato, subbicarinato, apice biangulato, ♂ apice truncato; metanoto velutino, bidentato, excavatione punctata instructo, nullomodo acute marginata; abdomine ovato-conico, sericeo, metanoti angulis utrinque fascia laterali aurantiaca; genibus, tibiis et tarsis præcipue anticis, testaceo-variis; alis fusco-cyaneis.

♂. Antennis subtus ferrugineis, scapi fascia flava; tarsis subtus sulfureis.

Monobia angulosa SAUSS. Vespides, I, 98, 6; pl. xv, fig. 5 (1852); III, 169.

Total length, 23 mm.; wing, 18 mm.

Large. Clypeus strongly punctured, almost in striæ; pyriform, at the extremity truncate, almost biangulate. Between the antennæ is a kind of tubercle, grooved above. Metathorax forming on each side a compressed tooth; the concavity a little striate and punctured, but the superior edges effaced; roughly punctured. Head and thorax densely punctured; the metathorax very rugose above. Abdomen conical as among the true *Rhynchium*, shining, punctures scattered; the border of the 2d segment and the following on the contrary very densely punctured, dull.

Body black with gray-silky reflections. Two spots on metathorax prolonged as lines on the inferior ridges, pale orange-yellow, or yellow. Wings black, with violaceous reflections. (Mexico.)

Var. a. Tarsi and anterior tibiae rather ferruginous. The first abdominal segment adorned on each side with a yellowish margin. (Brazil.)

b. Mandibles and extremity of clypeus brown ferruginous.

c. Metathorax black; only its inferior ridges yellow. (Surinam.)

d. The metathoracic cavity more or less punctured.

♂. Smaller. Clypeus black, punctured, rather short; its inferior border broadly truncate, or a little concave with its angles rather projecting. Antennae slender, armed with a terminal hook; beneath ferruginous; the scape with a yellow line. Often a yellow spot between the antennae. Anterior margin of prothorax rather concave. The angles of the metathorax blunt. Wing scales brownish. Tarsi sulphur-yellow, with a brown line on their superior face. (Brazil.)

Res. a. diff.—This is sufficiently distinguished from *M. biangulata* by its more rugose clypeus and the punctuation of its abdomen, for in this the border of segments 2d and 3d is shining, testaceous; and the segments 3d–5th are not more punctate than the 1st and 2d.

Hab. Mexico (Orizaba) and South America.

7. *M. biangulata* n. sp. (Fig. 12, 12a.)—Valida, nigra, punctata; *M. angulosa* affinisissima; metanoto valde excavato, foveola nitida tenuiter punctata instructo et utrinque angulato; macula frontali et subalari, puncto post-oculari, maculis 2 metanoti fasciaeque interrupta in pronoto et abdominis segmentorum margine 1, 2, fulvis; alis fusco-cyaneis.

Total length, 19 mm.; wing, 16 mm.

♀. Large. Head and thorax cribose with punctures; metathorax velvety, offering a circular concavity, deep, smooth, and finely punctured, but which is not bordered at the summit except by some depressed ridges; on each side a sharp dentiform angle is placed without the concavity. Abdomen smooth, sericeous, ovalo-conical; the first segment a little narrower than the second, rounded; the 2d and 3d segments both offering along their border a line which forms a separation like a second border.

Insect black, clothed with a fine gray pile. Scape of the antennae more or less ferruginous beneath. A spot on the face,

a point behind the summit of each eye, two spots or an incomplete border on prothorax, a spot under the wing and two on metathorax, pale yellow; first abdominal segment ornamented with a border of the same color, interrupted in the middle and extending along the sides; the 2d and 3d having their border brownish, the 2d beyond being ornamented with a pale yellow border, interrupted and submarginal. Coxæ 2d and 3d spotted with yellow; anterior tibiæ and tarsi varied with ferruginous; the hair of the legs a little golden. Wings brown, with violet reflections.

Res. a. diff.—This *Monobia* differs from *M. angulosa* by its clypeus, which presents a flat surface, bordered by two little arcuate, convergent ridges, which end in meeting the two dentiform terminal angles of the clypeus, which approach nearer than with the *M. angulosa*, where the ridges are straight; 2d, by the deeper concavity of the metathorax; 3d, by the structure of the border of segments 2, 3, of which one sees no trace in the *M. angulosa*.

Hab. The torrid parts of Mexico.

8. *M. nigripennis* n. sp.—Valida, nigra, valde cribrata; clypeo ♀ apice bidentato, fulvo-marginato; metanoto rugoso, bidentato, foveola punctata, sed haud acute marginata instructo, alis nigris.

Total length, 20 mm.; wing, 15 mm.

♀. Large. Appearance of a *Rhynchium*. Clypeus pyriform, convex, cribose with coarse pits, terminated by two dentiform angles. Head and thorax densely and coarsely cribose; back convex; anterior margin of prothorax crested; post-scutel punctured above; its posterior face coinciding with the truncation of the metathorax. This last rugose; its concavity distinct, punctured, but not inclosed; its upper edges effaced by the rugosities; on each side is a spiniform tooth. Abdomen conical, very densely punctured, velvety; the first segment nearly as wide as the second, anteriorly truncate, but not presenting any distinct edge; the 2d moderately long; those following not being more strongly punctured.

Insect entirely black, velvety; its hairs black; the feet only a little grayish; a spot on upper part of mandibles and a line along the latero-inferior borders of clypeus, tawny. Wings black, their terminal border only, a little whitish.

Res. a. diff.—This insect much resembles the *Monobia api-*

calipennis and is distinguished from it by the two spines of the metathorax, by the post-scutel without any crest, by its wings of which the extremity has but very little white, etc.

Hab. The hot regions of Mexico. I have taken a specimen near Tampico.

b. Metathorax without distinct spiniform angles.

9. *M. apicalipennis* SAUSS.—Nigra, capite et thorace densissime punctatis; abdomine ovato, velutino, tenuiter punctato, segmentorum margine paulo distinctius et densius punctato; capite satis minuto; clypeo truncato, subbidentato; thorace antice paulo coarctato, biangulato; post-scutello paulum transversim cristato, postice truncato; metanoto lævi, truncato, lato, rugoso, in medio foveola lævi instructo, sed ubique rotundato, canthis nullis, et nullomodo bidentato; clypeo, mandibulis, spatio post-oculari, antennarum scapo subtus, tibiis anticis antice, tarsis anticis apice unguibusque, rufis; alis nigris, apice albidis. ♀. Longit, 16 mm.

Monobia apicalipennis SAUSS. Vesp. I, 98, 5; pl. xv, fig. 6 (III, 168, var.?)

Hab. South America. (Typus in actoris museo.)

This species differs from the *M. nigripennis*, by its strongly angulate prothorax and by its rounded metathorax.

(I found in Mexico one of the *Apidæ* which could very easily be confounded with this *Monobia*.)

C. Abdomen slightly fusiform, enlarging as far as the extremity of the 2d segment; the 1st segment a little funnel-shaped, divided by a feeble longitudinal groove. Thorax lengthened.

These insects have the appearance of *Montezumia* and one would readily confound that with those of this genus, were it not for the rudiment of the 4th article of the labial palpi. They form the transition from *Montezumia*, and one can almost class these with that genus from the formation of their body; however, the structure of their palpi, their sessile abdomen having the first segment in form of a bell rather than funnel-shaped and above all their metathorax excavated and bidentate, assigns them their place among the *Monobia*.

10. *M. variabilis* n. sp.—Ferruginea, dense punctata; clypeo subbidentato; metanoto ferruginoso, foveolâ striatâ et utrinque dente instructo; abdomine basi angustiore, segmento primo flavo-limbato; capite et mesonoto nigro-variis; alis obscuris, violascentibus.

Total length, 18 mm.; wing, 15 mm.

♀. Forms of a *Montezumia*. Clypeus pyriform, strongly punctured, bicarinate laterally, terminated by two angles or teeth. Head and thorax very densely punctured; vertex offering a depression on its hinder part. Thorax rather elongate, slightly velvety; metathorax extending a little beyond the scutellum, very coarsely and densely punctured above, wrinkled, velvety; its concavity striate, limited by edges, not very apparent, because of the convex form of the two superior cheeks of the metathorax; and offering on each side a dentiform angle. Abdomen silky, almost velvety, punctured; its width augmenting as far as the extremity of the 2d segment; first segment narrower than the second, slightly funnel-shaped, and divided above by a groove; margin of the 2d a little bordered and densely punctured, as also those following.

Insect ferruginous. Antennæ black above in their second moiety; face varied with black; forehead and vertex black, with a ferruginous arc. Thorax varied with black beneath; mesothorax varied with black above on a red ground (or black varied with ferruginous); abdomen fulvo-velutinous, silky; base of 2d segment obscure; border of the 1st yellow. Wings brown, with golden and violet reflections.

Res. a. diff.—This species much resembles the *M. egregia*, but the 1st segment of the abdomen is longer and the metathoracic concavity is smaller and less flattened. The metathorax is more convex at summit and the thorax is more punctured. The colors are, without doubt, variable. It has much the same form as *M. californica*, but the body is much more punctured; the abdomen densely so.

Hab. Mexico. Oriental part. I caught a ♀ in the valley of Cordova.

11. *M. egregia* SAUSS.—*Statura M. variabilis et illi conformis; dense punctata; metanoto supra minus convexo, foveola latiore, valde striata, utrinque dente armata; abdominis primo segmento brevioris, antice truncato; capite, thorace et abd. primo segmento, nigris; segmentis reliquis rufis; clypeo, mandibulis, antennis, orbitis et in vertice fascia arcuata, pronoto, scutellis, tegulis, lineolis 2 mesonoti, macula subalari, lineolis 2 in metanoti canthis, tibiis, tarsis abdominisque segmentorum limbo, aurantiacis; alis ferrugineis.* ♀.

Variat. Pronoto flavo-marginato.

Monobia egregia SAUSS. *Vespides*, III, 168, 60; pl. iv, fig. 5, ♀ (1854).

Hab. The Antilles?

Gen. **NORTONIA** (MIMI).

Mandibles lengthened, dentate or lobate.

Lip and *jaws* lengthened; labial palpi composed of *four* articles; the first three armed with long hairs; maxillary palpi composed of *six* articles.

Clypeus pyriform, truncate or emarginate.

Abdomen having its first segment retracted, funnel-shaped or subcampanulate, subdentate in the middle.

Metathorax short, convex, its groove shallow, flattened behind, its lateral edges distinct.

The remainder as in the *Montezumia*.

This type establishes the transition of *Odynerus* to *Eumenes*.

The organs of the mouth are almost the same as in *Eumenes* and *Odynerus*, but the body has the form to which it inclines in *Montezumia*, the first segment being funnel-shaped, not sessile, as in *Odynerus*, but not contracted into a petiole as in *Eumenes*.

1. N. intermedia SAUSS.

Odynerus intermedius SAUSS. Vespides, I, 155, 39; pl. xvii, fig. I, III, 224 (1852).

Hab. Southern Europe.

2. N. symmorpha SAUSS.—Nigra, nitida, dense punctata; clypeo ♀ subemarginato, ♂ integro flavo; antennis subtus ferrugineis, scapo ♂ fascia flava; mesonoto bisulcato, metanoto medio foveolato, pronoto medio abdominisque segmentorum limbo ♂ 1-3, ♀ 1, 2, limbo, flavis; segmentis 2, 3 margine subreflexo; tibiis et tarsis flavis; alis fusco-violaceis.

Odynerus symmorphus SAUSS. Vespides, III, 246, 119 (1854).

Total length, 17 mm.; wing, 14 mm.

♀. Clypeus black; oval, convex, punctured; its inferior border channelled, terminated by a slender and shining, subemarginate, subbilobate lamina; between the antennæ a little transverse tubercle or carina. On the vertex is a transverse depression. Thorax moderate, ovate. Head and thorax punctured and clothed with a ferruginous pile; mesothorax marked on the posterior part of its disk with two or four longitudinal grooves;

metathorax small, very strongly and densely punctured, offering in the middle a little excavation, distinctly striate. Abdomen smooth, shining; the first segment funnel-shaped, subcampanulate, subpediculate, bidentate, strongly punctured and divided above by a distinct groove; border of the second and following segments densely punctured; the margin of the second and third slightly upturned.

Insect black, shining. Antennæ ferruginous beneath. Wing scales ferruginous, at times marked with yellow. A point behind each eye, a mark on middle of prothorax and border of segments 1, 2, yellow; the border of the first enlarged in the middle; border of third segment piceous; tibiæ and tarsi yellow. Wings of a transparent brown, with beautiful violet reflections.

♂. Clypeus wide, truncate, yellow. A mark on the front and a line on the scape of antennæ, yellow; their hook ferruginous; the third abdominal segment often bordered with yellow.

Var. No spot on the front, nor yellow border on the second abdominal segment (Florida).

Hab. The eastern United States, Florida, New York, Connecticut (3 ♀, 3 ♂, E. Norton).

3. *N. Tolteca* n. sp. (Fig. 13, 13a.)—Ferruginea, fulvo-hirsuta, sparse punctato-cribrata; clypeo bidentato; thorace ♀ dilatato, latissimo, maximo, depresso; ♂ normali; abdomine velutino, punctato, primo segmento infundibuliformi, supra linea impressa partito; secundo duplo latiore, margine reflexo; antennis ultra 4^m articulum supra nigris; alis ferrugineis, frequenter cyanescentibus.

Variat. Vertice, mesonoto, thorace subtus, abd. segmentis basi, nigris; segmentis flavo-limbatis; corpore flavo maculato.

♂. Minor; clypeo polygonali, flavo; antennarum uncino ferrugineo.

♀. Total length, 22 mm.; wing, 17 mm.

♂. Total length, 18 mm.; wing, 13 mm.

♀. Insect very stout, wide and depressed. Labial palpi composed of four articles; the fourth quite small; the maxillary, of six articles, the 2d and 3d long and slender; the last three small. Clypeus pyriform, wide, punctured, offering two little obtuse mammillæ; its inferior margin thinned, armed with two little separated lamellate teeth. Between the antennæ is a transverse carina, almost forming a little tubercle. Thorax strongly depressed, very wide, much wider than high, wider than the abdomen. Scutellum and post-scutel flat and depressed; metathorax

rounded; its cheeks, not dilated, separated by a cavity without distinct margin; on each side of metathorax, the *lateral* edge is quite distinct. Head narrower than thorax. Abdomen strongly retracted at the base of the second segment; the first subpediculate at the base, and suddenly enlarged, parted by a feebly excavated line near its border; second segment and often the third having their border feebly upturned. Head and thorax shining, wholly cribose and throughout bristling with a thick tomentose, orange, or ferruginous pile. The punctures are a little separated and the metathorax hardly rugose, but shining and punctured, like the rest of the thorax. Abdomen velvety, satin-like.

Insect ferruginous; some varying black colors in the sutures of the thorax and on the vertex. Antennæ black above, beyond the fourth article. Mesothorax often black with two ferruginous lines, either arcuate or terminating with a hook. Base of the abdominal segments often blackish and their border often yellow. Legs ferruginous with the tarsi yellowish. Wings ferruginous, washed with gray, with their terminal border margined with brown, and brilliant with beautiful golden reflections. Wings ferruginous or grayish, with purple reflections.

♂. Smaller; offering nothing very striking in form, the thorax not being inordinately wide as in the ♀; puncturation a little stronger. Face offering a little vertical carina, which extends to a little frontal tubercle on the clypeus; metathorax more rugose, garnished with a pile of gray hair; body a little less hirsute, thorax shorter; abdomen more slender; the first segment more lengthened, almost pyriform; more strongly punctured.

Clypeus yellow, polygonal; its inferior border with two little separated teeth. Hook of the antennæ ferruginous; orbits often bordered with yellow, scape of the antennæ often yellow beneath. Face, vertex, mesothorax, and middle of metathorax often black; border of the second and third segments strongly upturned; all the abdominal segments bordered with yellow. Wings subhyaline or amber colored or smoky, with violet reflections.

Var. ♀ ♂.—*a.* The thorax underneath black; abdomen either ferruginous or having the segments bordered with yellow.

b. Black; mandibles, lip, a spot beneath the antennæ, and a line behind the eye, yellow; prothorax ferruginous, with a yellow mark in the middle; two dots on the scutel and post-scutel yellow; metathorax ferruginous on both side, with its inferior edges

yellow; border of segments 1-3 yellow, the following ferruginous; the sides of the second segment chestnut-brown or ferruginous. (Cordova.) The colors are very variable.

c. (Highly-colored livery.) Forehead and vertex black, with a yellow spot between the antennæ. Thorax blackish or black, with the prothorax, two lines on the mesothorax, two spots or a band on the scutel, and the sides of metathorax, rufous; post-scutel yellow. The first abdominal segment blackish, with two rufous spots, or a band, and the hind margin yellow; the rest of the abdomen brown-rufous, with yellow margins. Feet black at base. Wings smoky, of a blackish-yellow with a golden reflection.—♂. Clypeus yellow, with a rufous shading.

Rees. a. diff.—The females are remarkable for the flatness of the scutels and of metathorax; for the separated punctures and the body hirsute with tawny hair almost as among the hairy insects. As regards color this exactly resembles the *Odynerus tuberculiceps*, and approaches very much the *Montezumia Brasiliensis* and *macrocephala* in form and in the ferruginous color.

Hab. The hot and the temperate regions of Mexico. I have taken diverse specimens of this interesting insect in the valley of Mezquitlan (eastern Cordillera), at Morelia, and at Pazcuaro (Michoacan).

Gen. **RHYNCHIUM** LATR.

Rygchium SPIKOLA, LATR., SAY, LEP., ST. FARG.

Rhynchium SAUSS.

This genus is so unnatural, that if one did not feel the necessity of separating as many species as possible from the large genus *Odynerus*, I should have abandoned it.

Indeed the *Rhynchium* only differ from the *Odynerus* by their large size, in the conical form of the abdomen, and in the lengthening of the maxillary palpi, of which the second and third joints are long and slender, while the last three taken together are not longer than the third. But this latter character seems to accord rather with the large size of the insect than with its peculiar form. Several *Odyneri* have a tendency to this, as for instance the *O. luctuosus*, which, however, differs in having the first segment shrunken and the abdomen not conic. We cannot say, therefore, where the genus is to be limited.

As to the conic form of the abdomen, it is met with in a great

number of species of true *Odynerus*, of which, however, the palpal articulations diminish quite regularly in size from the first to the fifth (*O. truncatus*, *O. nasidens*, etc.), so that this formation is not sufficient to characterize the genus.

The true *Rhynchium* belong especially to Africa. I know in America but one species which can figure in this group; it is the *Rh. dorsale* Fab., but even this species has not entirely the same palpi with the *Rhynchium*, for the last three articles are too large and the third is relatively too short. The *Odynerus luctuosus* might from its palpi figure as well in the genus *Rhynchium*, as the *Rh. dorsale*.

Beside this, if the smallness of the last three and the lengthening of the second and third palpal joint should separate generically the insect so distinguished, it would be necessary to form quite a corresponding genus of the great African and Asiatic *Eumenes* (vide Saussure Vespidae, I; pl. iv, fig. 2, b), and separate generically, *f. i.*, the *E. conicus* from the *E. coangustatus*, which would be an impossibility. I see, therefore, no need of adopting the genus *Rhynchium* in the description of the American fauna, the utility of doing which appears the less as it would only free the genus *Odynerus* from one species. I have consequently left this species in the latter genus.¹

1. *Rh. dorsale* FABR.—(Vide *Odynerus dorsalis*, p. 257).

Gen. **ODYNERUS** LATR.

Abdomen sessile or subsessile. *Labial palpi* 4-articulate. *Maxillary palpi* 6-articulate. *Mandibles* elongate, as in *Eumenes*, more or less toothed. The second cubital cell not petiolate.

This genus may be distinguished by its elongated mandibles and sessile abdomen. In numerous species, however, the abdomen is subpedunculate, that is, the first segment is rather funnel-shaped,

¹ In my *Studies on the Families of the Vespidae* I also described as an American *Rhynchium* the *Rh. limbatum*, p. 117, 27; pl. xv, fig. 10 (not 9). But this type, now in my possession, in consequence of the acquisition of the collection of the late M. de Romand, appears to me incontestably Asiatic. Like many others in this collection, it bore a wrong label.

but never as much petiolated as in *Eumenes*, the base only of the first segment being slender, if at all, while its extremity always envelops the base of the 2d segment. The form of the different parts of the body is quite variable. The thorax is short or elongate, angulate or rounded, the abdomen may be thick or slender, quite conical and sessile or sessile and not conical, but ovate and cylindrical; it becomes also subpetiolate, the first segment being more cup-shaped or campanulate. The abdomen is also often attenuated anteriorly and posteriorly, which makes it spindle-shaped, etc. Several of these forms make transitions to other genera. In *Odynerus*, as in all the genera with more or less sessile abdomen, the styliform appendages at the end of the posterior tibiae are not as much developed as in the petiolate genera. The exterior spine of the hinder femora is always small. The *Odynerus* are distinguished: from *Alastor* by their wings, which have the 2d cubital cell not petiolate upon the radial cell; from *Pterochilus* by their labial palpi, comparatively small and not pectinate or feathery; from *Montezumia* by a different facies and by the composition of their palpi; from *Monobia* only by the formation of the palpi.

It is to *Nortonia* that these insects have the most similarity. They differ by their less petiolate abdomen (really not petiolate) and by the emarginate or variable metathorax, which in *Nortonia* remains as in *Eumenes*, convex and stubbed.

Nevertheless it would be difficult to set a distinct limit between *Odynerus* and the most closely allied genera. = Ex.:—

Transitions to Alastor.—In most species of *Odynerus* the 2d cubital cell has a little radial edge which makes it very distinct from *Alastor*, but in some intermediate types the 2d cubital cell becomes quite triangular, only touching the radial cell with its anterior angles. This is really quite a transition to *Alastor*, but we keep the intermediate types in the genus *Odynerus*, reserving for the genus *Alastor* only the species in which the 2d cubital cell is distinctly petiolate upon the radial cell.

Transitions to Pterochilus.—In the subgenus *Epipona*, the thorax becomes short and rounded, the abdomen oval and depressed. The whole insect assumes quite the appearance of a *Pterochilus* and can only be distinguished by its normal labial palpi.

Transitions to Monobia.—As said above, the two genera can



only be distinguished by the composition of the palpi, which are not 4- and 6-jointed in *Monobia*, as in *Odynerus*.

Transitions to Montezumia.—A few Odyneri take the appearance of *Montezumia*, the first abdominal segment becoming quite funnel-shaped (*O. tapiensis*, etc.). In this case they can only be distinguished by the examination of the palpi. But in general the facies is very different in *Odynerus*.

Transitions to Nortonia.—A number of *Odynerus* have the abdomen subpetiolate, the first abdominal segment becoming elongate. This is especially the case in the species of the subgenus *Odynerus*, Division *Hypodynerus*. These form a regular transition to *Nortonia*, and are only distinguished by their appearance and more angulate metathorax; the first segment has also a more triangular, depressed, and gibbous form, not being funnel-shaped in the same way. In *Nortonia* it is properly funnel-shaped. In *Hypodynerus* a sort of petiole only is formed by the anterior face of the first abdominal segment. *Nortonia* is quite intermediate between *Odynerus* and *Eumenes*, while *Hypodynerus* quite connects itself with *Odynerus* by decided transitions, and has the thorax very different from *Eumenes*. Indeed in *Nortonia* the petiole cannot be doubted when the abdomen is elevated; while in *Hypodynerus*, when the abdomen is raised, the anterior face of the first segment is applied against the metathorax and fits against it, and one can only see the upper face of the segment, which is quite transverse and which causes the abdomen to appear quite sessile.

Though it is not possible to define a trenchant limit between *Nortonia* and *Odynerus*, yet as the most changeable types are not American, it would be superfluous to insist upon this point.

Geographical distribution.—The genus *Odynerus* is much the greatest among the Vespidae, and, in a philosophical point of view, one might take it for the stem of the family.

Judging by the numerous species which have been found in the countries already explored; by the number known in North America and in Europe; by the numerous species which have resulted from my researches in Mexico (although I could only give to it very little time), and by what other travellers have brought from various parts of the world, it is beyond doubt that there exist more than a thousand species of *Odynerus*, and

perhaps nearly double this number, for there is no region of the globe which does not offer an abundance of these insects.

Therefore the prospect of the future leads us to see riches which by their very abundance will bring the entomologist to desperation in keeping the genus *Odynerus* out of a general chaos.

Among the so various forms of this group, some are characteristic of general zoological groups, which form natural subdivisions of the genus. These forms present themselves on several continents and are not peculiar to all the species of one continent. Other forms are, on the contrary, so to speak, mere geographical impressions, which belong to particular regions of the globe, which stamp their character upon all the species of those localities, through all the genera, but are not to be found in other countries.

Examples of modification in the first way.—(General zoological modification, special to one or several genera, but not peculiar to one country.)

a. The modification of the first segment of the abdomen, taking a transverse suture (subgenus *Ancistrocerus* and *Symmorphus*) is to be found on the whole globe. It forms quite a zoological group, repeated in *Odynerus* and in *Alastor*.

b. The modification of the antennæ of the males simple, not taking a terminal hook. This is to be found amid the *Odyneri* with a sutural first segment, in *Symmorphus*. The *Symmorphus* are spread over the northern hemisphere, mixed up with *Odyneri* having hooked antennæ.

c. This same character of the ♂ antennæ destitute of a hook appears also in the *true Odyneri*, where it forms the division *Pachodynerus*, but in those insects it is already a more geographical character, for the *Pachodynerus* is a special American type spread over the new continent, and is particularly abundant in the central parts. But, though quite American, it is not exclusively a geographical group, for in America it is mixed with *Odyneri* of other groups.

This same character also presents itself and much in the same way in the genus *Eumenes* where it forms the Division *Omicron*, resuming the species with simple ♂ antennæ and has just the same geographical type as *Pachodynerus*, being only American, but also mingled in America with the hooked *Eumenes*. This

character is a regular zoological one, for it advances together with a thick and short thorax in both genera.

Examples of the second modification.—(Local geographical modification, not peculiar to one or several genera, but quite special to one country.)

a. As a very striking example in this way, one could not choose better than in the group of Chilean Vespidae. This forms quite a remarkable collection of species, all having the same very striking appearance. Indeed, all the Chilean Vespidae, to whatever genus they belong, have the same peculiar livery; black, with long black hair and whitish ornaments; with rufous or black feet, rufous wings obscure at the apex. This livery (with its varieties) is so striking, that one may at the first look distinguish a Chilean species, and this facies is to be found in all the genera, *Odynerus*, *Gayella*, *Ctenochilus*, *Alastor*, etc. The forms of the body, although quite variable, are also very characteristic in their appearance. In the Chilean *true Odynerus* they even become so very peculiar that we have been forced to make for them the Division *Hypodynerus*. Nevertheless this is not properly a zoological group, as it is again found in all the genera, but is evidently only a stamp of the country which every species of any genus seems to receive when it has the citizenship of that country.

b. The species which populate the continuation of the same region in the north, that is, the occidental side of the Andes of Ecuador and New Granada, have also a peculiar facies, still similar to that of Chili, but more approximate to the common type of *Odynerus*. They are still hirsute with long black pile, black-velutinous, but the ornaments are golden-yellow; the wings are no longer ferruginous. The same character is also apparent in other genera (f. i. *Pachymenes ventricosa*).

c. In the Antilles the *Odyneri* are more marked, and have common forms. They take a rich livery, with numerous orange-yellow bands and spots. The same modification may be noticed in all the other genera of Vespidae in this region, even in the social wasps.

d. In the Mexican region there are to be found types, with dull rufous colors and with the margin of the 2d abdominal segment channelled and reflexed; the *Stenodynerus* become quite abundant, with a velutinous body (*O. huastecus*, *otomitus*, etc.),

or very elongate, naked, with white ornaments (*tolonacus*, *chichimecus*, etc.). But numerous species have also the normal forms.

e. In the United States, oriental side, the *Odyneri* and all the Vespidae take the same characters as in Europe, as to forms and coloration; except that the wings are more obscure.

f. In the prairies of the southwest, the colors grow pale; the black passes into ferruginous.

g. On the occidental coast the yellow ornaments become bright sulphur-yellow and extend over a great part of the body.

These considerations of the geography of the species, and conversely on the modifications which follow their distribution, have been too much neglected up to this day. They have a high importance in the study of the origin of species, and they require the attention of entomologists, who alone can fix them, for only those who have much to do with numerous insects can make the frequent and minute observations which enable one to generalize rules of any value. And if entomology does not do its share in helping to elucidate the questions of natural philosophy, it will be a mere amusement of amateurs and will fall to the lowest rank of the science.

Classification.—Notwithstanding the vastness of the genus *Odynerus* and the various forms which it offers, one cannot well arrange its species according to Sections, which are easy to discover. This results, first from the multiplicity of the transitions which almost insensibly ally each form with several others, and often conduct from one form to another in various ways; it results also from the multitude of details of form which make their appearance in the same series, creating a great perplexity in subordinating the characters to a system. Far from being able to establish large divisions, to be subdivided according to a regular succession, one gets lost in numberless details and exceptions which quite disorganize the subdivisions, so that it can only be defined by loose indications in which the reader becomes lost. This I must say for excuse, if I have not given better characteristics.

The evil would be perfectly irremediable in a general system of the *Odyneri*, in which the complication would become quite a sort of chaos, as each continent possesses its series of special forms, with numerous ramifications, beside the general series

common to most parts of the globe. The evil is much less if the fauna of one continent-only is considered.

The only groups which can be well defined are the four subgenera which Wesmael has indicated and which we have adopted in our *Etudes sur la Famille des Vespides*.¹ These subgenera we are obliged to subdivide again to justify the arrangement of the species, but it is prudent to say that these subdivisions are very artificial, and that one must not trust too much to the definitions of them, because of the difficulty of involving in them all the exceptional forms, as well as of giving a true description of the details of the forms.

Definition of the subgenera.

- A. First abdominal segment parted by a transverse suture.
 - a. First abdominal segment rather funnel-shaped, parted by a deep longitudinal groove; antennæ of the males simple, that is, without a terminal hook. *Symmorphus.*
 - b. First abdominal segment truncate at base, not parted by a deep longitudinal groove; antennæ of the males terminated by a hook. *Ancistrocerus.*
- B. First abdominal segment with no transverse suture.
 - c. Thorax more or less square anteriorly; abdomen conical, oval-conical or spindle-shaped. *Odynerus.*
 - d. Thorax more globular or oval, rounded posteriorly, not very square anteriorly. Abdomen oval, sessile, more or less depressed, having the same form as in *Pterochilus* (sublenticular). *Epiponus.*

The last two sections rather overlap each other; those preceding are more defined and easier to distinguish. All of the four subgenera are represented in North America. The 4th is the only one which has not yet been discovered in South America. Although these groups are not sharply defined, their respective representatives can be easily distinguished by the eye, if one is thoroughly familiar with their facies. The only very embarrassing types are those which unite *Odynerus* with *Epiponus*, but they are not American.

Determination of the species.

We must here say, that, the most important specific characters of the *Odyneri* being in the metathorax, the insects must be prepared with the abdomen bent downward, so as to leave the hinder

¹ Comp. this work, vol. I, p. 118-121.

face of metathorax quite free, and with the wings removed side-wise. If not prepared in this way, it is impossible to determine them with certainty. Before all things, one must thoroughly acquaint himself with the characters of the metathorax, which I will briefly repeat for this purpose.¹

In the most characteristic type, the metathorax is truncate, together with the post-scutel; its hinder face is excavated, and the excavation or hinder plate is angulate, forming on each side a lateral dentiform angle.² The concavity is also margined with sharp ridges.—The ridges running from the lateral angles up to the angles of the post-scutel are the *superior edges*; the ridges running from the lateral angles down to the articulation of the abdomen, are the *inferior edges*.—Beside these, there is a third sort of edge placed on the lateral faces of metathorax, running from the lateral angles to the base of the posterior wing; these are the *lateral edges*. There should be no confusion between the *superior ridges*, which, seen from behind, may also be taken for *lateral ridges*. The superior edges are often rather elevated, and at their superior extremities are separated from the post-scutel by a little fissure or by a notch. These characters become more and more effaced in the series of species until the metathorax becomes quite convex, rounded, destitute of ridges, except on the lateral edges, which nearly always continue, more or less. The superior ridges become less salient, no longer making a sort of tooth behind the post-scutel; they then become blunted (*O. dorsalis*); or quite effaced (*O. sulfureus*, *pratensis*); finally, also, the lateral angles disappear. In another series the margins of the hinder plate of mesothorax are quite arcuated, and there are no lateral angles, although the margins are very sharp (*O. Megæra*, *turpis*, etc.); but, nevertheless, the same names can be applied for the *superior* and *inferior* part of the marginal ridges. These circular margins also become more and more blunted (*O. molestus*), until the metathorax becomes quite convex, rounded, as in the preceding case (*O. leucomelas*). In some cases the lateral ridges are continued with the inferior ridges, the superior ones being effaced, etc. (Numerous *Stenodyneri*.)

¹ I have noticed this in my *Etudes sur la Famille des Vespides*, vol. III, p. 184; pl. xii, fig. 1, 2, 3.

² Compare *Odyn. Hidalgoi*, *Boscii*, *dorsalis*, *nasidens*, *Cubensis*, *capra*, etc.

In conclusion, I must add, that in most cases it is impossible to determine a species in this large genus with certainty, if it is not represented by more or less numerous specimens, because the forms of the mesothorax are more or less variable in the same species. One must also make the determination upon females, the males being less distinctly characterized. They must be separated by the eye to their respective females.

Subgenus **SYMMORPHUS**¹ Wesm.

Body lengthened. Abdomen subsessile, the first segment funnel-shaped, carrying a strong, transverse suture, and divided on its superior face by a deep, longitudinal groove. Antennæ thick; those of the males simple, with no terminal hook.

The insects which enter into this group inhabit Europe and America. They all present quite a similarity in form, which is the reason of their name. Their body is more or less slender; the clypeus is rounded, a little hollowed; the thorax is lengthened, smooth, but traversed in all its length by two arcuate grooves; the post-scutel, the metathorax, and often the first segment of the abdomen are rugose; this last, while it is funnel-shaped, is also truncated anteriorly before the suture and is, in consequence, less petiolate than in the *Nortonia*. One notices among these insects a particular marking; the 3d abdominal segment often loses its bordering, while the 4th preserves it, and among the females the clypeus, while it does not become wholly black, takes at the summit a yellow medial spot and not two lateral spots as mostly in *Ancistrocerus*.

The insects of this group are very easily distinguished by their first abdominal segment *provided with a suture and divided by a longitudinal groove*. They share this character with the *Nortonia* only—the short thorax, the rounded metathorax, the more pediculate abdomen, and the absence of the suture of the first segment of which, suffice for a distinction.

¹ In my *Etudes sur la Famille des Vespides* (T. III, p. 186), I have substituted the name of *Protodynerus* for that of *Symmorphus*, under the belief that the name *Symmorpha* had been employed during the same year. But as the two terms are not absolutely identical, it seems best to me to preserve the so-well-chosen name which Mr. Wesmael proposes.

One finds in America and in Europe some *corresponding* species, so to speak, which reproduce in each country the same forms and the same distribution of colors.

a. Segments 1-4 of the abdomen bordered with yellow.

1. *S. Walshianus* n. sp.—Niger, punctatus, gracilis, postscutello et metanoto rugosis; mesonoto sparse, scutello crassius, abdominis primo segmento grosse, punctatis; puncto frontali et post-oculari, maculis 2 pronoti, 2 scutelli et utrinque 1 subalari, tegulis abdominisque segmentorum 1-4 limbo, flavis; tibiis et tarsis flavis; alis fusco-nebulosis.

♀. Macula in summo clypeo flava.

Total length, 12 mm.; wing, 10 mm.

♀. Of a larger size than the *O. Philadelphix*, but of a similar form. Clypeus bidentate, punctured, and rugose toward the base. Thorax less lengthened than in the species cited above. Prothorax finely rimmed but not bidentate. Head and thorax quite densely punctured; the punctures effaced on the summit of the mesothorax, which bears only some scarce punctures and which is traversed by two grooves in its whole length. Clypeus cribose with points which are coarser, but separated and few, indistinctly divided by a groove. Post-scutel and metathorax very rugose; the first presents, on its anterior border, a feeble, rugose, divided projection, which does not extend as far as the angles. Plate of the metathorax strongly rimmed but not bidentate. Abdomen shining. The first segment coarsely cribose above with large punctures and divided by a groove; its suture very strong; the first moiety of the 2d segment, its extremity, the 3d, and the 4th, punctured.

Insect black, clothed with a short grayish pile. A spot on the summit of the clypeus, a mark between the antennæ, a little point behind the summit of the eyes, an interrupted line on the scape of the antennæ, two spots on the prothorax, one beneath the wing, two on the scutellum, and the border of the segments 1-4 yellow; the bordering of the first two a little festooned, especially that of the first, which is a little enlarged in the middle. Wing scale yellow, with a testaceous point. Legs black; knees, tibiæ, and tarsi yellow; the last article of the tarsi brownish. Wings smoky, with light violet and golden reflections.

The markings are of a golden yellow.

♂. Unknown.

Res. a. diff.—This species differs from the *O. Philadelphix* in its greater size, its more complete marking, the 3d segment of the abdomen being bordered with yellow; in its yellow wing scales, tibiæ, and tarsi, in its thorax, less lengthened, and not bidentate upon its anterior angles; in a slightly different puncturation.

One could say that the *O. Walshianus* is the American representative of the *O. gracilis* Wesm., an entirely corresponding species of Europe, although smaller, and more ornamented with yellow, having a more slender thorax and a bidentate prothorax.

The *O. Walshianus* is quite intermediate between the *O. crassicornis* and the *O. gracilis*, both in the forms and size, but its yellow markings are less extended, as may be observed in general of the American species.

It differs from the *O. pumilus* in its greater size, in its less slender form, in its prothorax which is not bidentate, in its first abdominal segment which has the superior face twice as wide as long, etc.

Hab. The United States. Illinois.

I possess but one female, sent by Mr. Benj. D. Walsh, to whom I dedicate the species.

b. Segments 1, 3, 4 of the abdomen bordered with yellow.

2. 8. Philadelphix SAUSS.—Niger, punctatus, gracilior, post-scutello et metanoto rugosis; abdominis primo segmento valde punctato; reliquis nitidis; puncto frontali et post-oculari, maculis 2 pronoti, macula subalari, maculis 2 scutelli et abdominis segmentorum 1ⁱ, 2ⁱ, 4ⁱ limbo, flavis; tegulis nigris; tibiis flavo-variis.

♀. Clypeo nigro frequenter macula flava; ♂. Clypeo flavo, mandibulis, linea in scapo antennarum, et 5ⁱ segmenti limbo, flavis.

Odyn. Philadelphix SAUSS. *Revue Zool.*, IX, 1857, 272.

Total length, 11 mm.; wing, 8.5 mm.

♀. In form very slender and lengthened. Clypeus rounded, convex, punctate, hollowed, and distinctly bidentate. Thorax much lengthened; prothorax rimmed, its angles a little salient; mesothorax traversed in its whole length by two strong grooves; its anterior part punctured, like the prothorax; the remainder of the disk smooth, finely punctured; scutellum smooth, divided by a large groove; post-scutel and metathorax very rugose; the

first forming a little rugose crest; the trench of this last bordered with trenchant and rugose ridges. Abdomen very slender; the first segment lengthened, funnel-shaped; its upper face as long as wide, rather coarsely punctured, divided by an indistinct groove; the suture strong, arcuate. The other segments smooth.

Insect black. A spot at the summit of clypeus, another between the antennæ, a dot behind each eye, two spots on the prothorax, one below the wing, two on the scutellum, and the border of segments 1, 2, 4, yellow. Tarsi ferruginous beneath; tibiæ marked with yellow at the summit; the anterior pair yellow. Wings transparent, a little washed with brown. Wing scales black.

Var. a. Spot on the clypeus very small.

b. Clypeus wholly black.

♂. A little smaller. Clypeus, rounded and bidentate, pale yellow; mandibles yellow before, bordered with black; a yellow line on the scape of the antennæ; extremity of the flagellum a little ferruginous beneath. The yellow dots of the head and thorax small; that under the wing sometimes wanting. A yellow border upon the 5th segment. Tibiæ yellow; tarsi yellow, gray at the extremity. Groove of the first segment deeper.

Res. a. diff.—This species greatly resembles the *O. sinuatus* Fabr., although its markings are less rich. But its first abdominal segment is much less coarsely punctured and the dividing groove much less pronounced. It differs from the *O. pumilus* in its much greater size, in its first segment being less rugose, and in its different ornamentation.

Hab. North America. Pennsylvania. New York. Canada. Prairies. Fort Tejon. California. 6 ♀, 1 ♂.

3. *S. albomarginatus* SAUSS.—Niger, punctatus; metanoto rugoso; abdominis primo segmento grosse punctato, sutura elevata; puncto inter antennis et frequenter altero in summo clypeo, maculis 2 pronoti, 2 scutelli, puncto subalari abdominisque segmentorum 1-4 marginibus, albidis; tibiis albido-variis; tarsis subtus ferrugineis. Alis hyalinis. Longit, 9 mm.

Variat. Abdominis tertio segmento haud marginato.

Odynerus albomarginatus SAUSS. Et. Vespides, III, 1854, 195, 90, ♀.

Hab. America borealis, Hudson's Bay. (Typus in Mus. Londinensi.) Connecticut. (Ed. Norton.)

c. Segments 1, 2 only, of the abdomen bordered with yellow.

4. *S. debilis* n. sp.—Niger, punctatus, maxime elongatus, gracillimus; postscutello et metanoto rugosis; hoc maxime pone post-scutellum producto; abdominis primo segmento elongato, grosse punctato, sulco valde diviso; puncto frontali et post-oculari, punctis 2 scutelli, macula subalari sulfureis; abdominis segmentorum 1^a, 2^a fascia marginali sulfurea, secunda interrupta; tibiis basi sulfureis; alis hyalinis, tegulis fusco-nigris. ♀.

Total length, 8.5 mm.; wing, 7 mm.

♀. Small and extremely slender. Form much lengthened. Head large, higher than wide; antennæ inserted notably below the middle of its height. Clypeus widely and not deeply hollowed, subbidentate, a little rugose toward the bottom. Head finely punctured. Thorax very long; prothorax punctured, finely rimmed, forming on each side a very small tooth. Mesothorax and clypeus little punctured; this last divided by a very large groove. Post-scutel and metathorax very rugose; the first flattened obliquely, bordered before; the second *strongly prolonged* behind; its concavity oblique, strongly hemmed, especially toward the top a little striate.

Abdomen very long and slender. The first segment of a lengthened funnel-shape, longer than wide, its suture very strong, a little angulate in the middle; its surface very coarsely punctured and divided by a wide and strong groove. The remainder smooth. Insect of a shining black; a spot between the antennæ, a dot behind each eye, two spots on the prothorax, one beneath the wing, two dots on the scutellum and the marginal belt of the first segment of the abdomen, sulphur-yellow; the 2d segment ornamented with a yellow border (sometimes interrupted), which is almost wanting beneath. Legs black. Tibiæ and anterior tarsi and the superior moiety of the tibiæ of the other pairs, yellow; tarsi ferruginous. Wings transparent, a little brown on the side about the stigma. Wing scales brown or black.

Var. On the 4th segment a trace of a border and at times a dot at the summit of the clypeus, yellow.

♂. Unknown.

Revs. a. diff.—This little species differs essentially from the *O. Philadelphix* in its more slender form, in the head being higher than wide, in its much prolonged metathorax, in its more rugose first segment, its very much more decided suture, and in the yel-

low livery of its abdomen. It closely recalls the *O. bifasciatus* Fabr., although its head is narrower and its clypeus more emarginate. It also closely approaches the *O. debilitatus* Sauss., which has nearly the same form of head, but which is less slender and has the thorax especially, much more strongly spinose.

Hab. United States. Connecticut. Wisconsin. Illinois.

I owe this interesting species to the kindness of Mr. Edward Norton and Mr. B. D. Walsh.

5. *S. pumilus* SAUSS.—Gracilis, niger, nitidus, tenuiter punctatus; pronoto biangulato; post-scutello et metanoto rugosis; illo postice excavato, antice paulum altiore et utrinque in lateribus carinula longitudinali marginato; hoc profunde excavato, foveola elevato-marginata instructo; mesonoto valde sulcato; scutello sulco valde partito; abdominis primo segmento elongato, sutura valde prominula instructo, superne rugosissime punctato et sulco obsoleto diviso; segmentis reliquis nitidissimis; puncto frontali et post-oculari, maculis 2 pronoti, 2 scutelli, puncto subalari, limboque segmentorum abdominis omnium, flavis; (segmentorum 3-5 fascia undulata submarginali); pedibus nigris, tibiis tarsisque flavis; alis hyalinis, venis ferrugineis. ♂. Clypeo rotundato, bidentato; mandibulis et scapo antice fascia flava. Longit., 9 mm.

Odgn. pumilus SAUSS. Vespides, III, 1854, 197, 93.

Hab. Peru. (The author's collection.)

6. *S. cristatus* SAUSS.—Sat parvus, niger, *O. murario* formis similis; metanoto rugoso; abdominis primo segmento sat grosse punctato, sutura elevata, secundo latiore, basi punctato; puncto frontali, maculis 2 pronoti, fascia interrupta scutelli, macula subalari, flavis vel rufis; abdominis segmentis 1, 2, 4 sulfureo limbatis; tibiis tarsisque ferrugineo-varis; alis hyalinis, venis fuscis, radio ferrugineo. ♀. Long. 9 mm.

Odynerus cristatus SAUSS. Vespides, III, 196, 92, ♀.

Hab. North America.

This species appears to me to be very nearly, if not wholly identical with *O. Philadelphæ*.

7. *S. Canadensis* SAUSS.—Parvulus, niger, gracilis, rugosus; puncto frontali, maculis 2 pronoti, 2 scutelli, macula subalari, abdominisque limbo segmentorum 1ⁱ, 2ⁱ, 4ⁱ, flavis; tegulis fuscis; capite inflato, antennis infere insertis; abdominis secundo segmento angusto, viz latiore quam primum; alis hyalinis, apice fusciscentibus. ♀. Longit., 8 mm.

Odynerus canadensis SAUSS. Vespides, III, 196, 91, ♀.

Hab. Canada.

This species, like the preceding, has not been described with sufficient precision to be recognized with certainty, until the number of species has been augmented. It appears to be very near to the *O. debilis* in the form of its head and abdomen.

Subgenus **ANCISTROCERUS** Wesm.

The first abdominal segment divided by a transverse suture; its superior face (situated behind the suture) not divided by a deep groove. Antennæ of the males terminated by a hook.

This subgenus includes insects of variable forms, in which, although they are very hard to define, we can distinguish four principal types. These are mere divisions of the subgenus.

- A. *The second cubital cell of the wing having a distinct radial side.*
 - a. Form rather depressed, more chubby; the upper face of the 1st abdominal segment transverse. *Ancistrocerus*.¹
 - b. Form rather cylindrical, more slender.
 - * The hinder face of the metathorax more or less excavated; the border of the excavation rough or rounded. *Stenancistrocerus*.
 - ** The hinder face of the metathorax having a deep round cavity, surrounded by a very sharp circular ridge. *Hypancistrocerus*.
- B. *The second cubital cell of the wing triangular, quite contracted on its radial side, but not petiolate.* *Ancistroceroides*.

Division **ANCISTROCERUS** (properly speaking).

SAUSSURE Et. Vespides, I, Section 1, a, p. 135; b, p. 139.—III, Section 1, p. 216.

Abdomen quite depressed, sessile; its first segment truncate anteriorly so as to show two faces, one anterior and one superior; its two faces distinctly separated by the suture; the superior one forming a wide square or a transverse band. This segment short and wide. Thorax flattened above; disk of the mesonotum offering at its base two longitudinal grooves.

The insects of this series have their form rather depressed than cylindrical. They are generally rather wide, but are sometimes slender; the thorax is somewhat cubical, although generally

¹ The division *Ancistrocerus* is also to be distinguished by the fact, that the yellow margin of the first segment is a band, either regular, or widened on the sides, while in the others it is generally either regular or narrowed on the sides.

lengthened and rather flattened above. The clypeus is pyriform among the females, but is usually wide or wider than long; its extremity terminates in a little border, channelled by a small trench which often makes it appear bidentate; among the males it is polygonal and bidentate. The disk of the mesothorax offers two or four grooves on its hinder part. Above all the metathorax is very characteristic. It is a little oblique. Its posterior plate always presents an excavation, which is divided by a vertical carina. The post-scutellum is truncate, at times subcrenulate, but its trench never coincides with that of the metathoracic fossette. The abdomen, always depressed and sessile, has an ovalo-conic, never flatly conic form. It is at times velvety, never coarsely punctured, except perhaps on borders of the segments. The first segment is wide, cut squarely and shortly above.

In fine, even when the form is much lengthened (*O. tigris*), the general appearance is preserved, the body being rather flattened than cylindrical. In this group the males are quite variable. Among certain species they nearly assume the size of the females. Among others they are very much smaller and vary endlessly in form, so that one can scarcely refer them to their females, but by a series of groupings.

*Table to assist in the determination of the species of ASCISTROCERUS
(principally based upon the females).*

- | | |
|---|---------------------------|
| 1. Wings fusco-violaceous. | |
| 2. Margin of second segment smooth; post-scutel black. | 11. <i>Spinolæ.</i> |
| 2, 2. Margin of second segment rough; post-scutel yellow. | 24. <i>unifasciatus.</i> |
| 1, 1. Wings subhyaline or smoky. | |
| 2. Margin of the second segment reflexed | |
| 3. Color rufous, vertex tuberculate. | 26. <i>tuberculiceps.</i> |
| 3, 3. Color black, argenteous. | 29. <i>Aristæ.</i> |
| 2, 2. Margin of the second segment not reflexed. | |
| 3. Abdomen and antennæ mostly yellow. | 27. <i>Sutterianus.</i> |
| 3, 3. Abdomen and antennæ mostly black. | |
| 4. Metathorax with two long spines; angle of prothorax dentate. | 19. <i>Clarazianus.</i> |
| 4, 4. Metathorax with short spines or not dentate. | |
| 5. Thorax black, body velvety. | |
| 6. The first abd. segment not margined with yellow. | 23. <i>Parredesi.</i> |

- 6, 6. The first abd. segment margined with yellow.
- 7. Two yellow fasciæ on the abdomen. 28. *pilosus*.
- 7, 7. Five yellow fasciæ on the abdomen. 18. *Sylveiræ*.
- 5, 5. Thorax black, with yellow or luteous ornaments; body sericeous or shining, not velvety.
- 6. Abdomen with 2 yellow or luteous fasciæ.
- 7. Body very coarsely punctate, posterior margin of prothorax luteous. 21. *conspicuus*.
- 7, 7. Body not very coarsely punctate; anterior margin of prothorax yellow.
- 8. Post-scutel black. 9. *ambiguus*.
- 8, 8. Post-scutel yellow. 22. *cingulatus*.
- 6, 6. Abdomen with 3 yellow fasciæ.
- 7. Post-scutel black. 16. *Santa-Annæ*.
- 7, 7. Post-scutel yellow. 25. *campestris*.
- 6, 6, 6. Abdomen with 4 or 5 yellow fasciæ.
- 7. Thorax cubic, short.
- 8. Two yellow spots on the second segment. 20. *birenimaculatus*.
- 8, 8. No yellow spots on the second segment. 20. *birenimaculatus*.
- 17. *Bustamenti*.
- 7, 7. Thorax more elongate.
- 8. Metathorax with sharply defined border.
- 9. Post-scutel black.
- 10. Ornaments yellow. 10. *capra*.
- 14. *adiabatus*.
- 10, 10. Ornaments white. 12. *albophaleratus*.
- 9, 9. Post-scutel more or less yellow
- 10. Body normal.
- 11. Color gray, sericeous. 18. *Sylveiræ*.
- 11, 11. Color black, shining. 15. *fastidiosusculus*.
- 12. *Catskillensis*.
- 10, 10. Body slender, elongate. 8. *tigris*.
- 8, 8. Metathorax rounded behind. 25. *campestris*.

I. *Metathorax having its concavity angulate, bordered all around by trenchant edges* (Sect. I, a, Sauss. *Vespides*, I, 135).

(Group of *O. parietum* LINN.)

Among these insects the metathoracic cavity has a polygonal form, determined by its angulate edges. The medial carina divides the fossette into two equal parts, which can be compared in form to two coupled pentagons. Their angles often make on each side a sort of tooth (which is variable among individuals of

the same species, as it happens to be more or less developed); and at the summit two other teeth separated at the post-scutel by a sort of groove or wide fissure. The concavity is in general punctured, but is often striate in the middle or toward the base.

The *Ancistrocerus* of this division are very common, both in Europe and North America; one can even find *corresponding types* among the species analogous to the two countries. However, I have never met the same identical species upon the two continents.

Here, as in other solitary wasps, the American species are generally less ornamented with yellow than the European; the bands are narrower and the wings have a much greater tendency to pass into brown-violet. In short, the American types have a more sober appearance.

A. Form lengthened, slender.

S. A. tigris SAUSS.—Sat minutus, niger, punctatus, *gracillimus*; metanoti foveola subrugosa, acute marginata, utrinque in dentem excurrente, marginibus rectis; puncto in basi mandibularum, ♀ maculis 4 in clypeo, puncto frontali et post-oculari, linea in scapo, fascia bilobata pronoti, macula subalari, 2 scutelli, post-scutello et abdominis segmentorum marginibus anguste, tibiis tarsisque, flavis; antennis subtus ferrugineis; alis hyalinis, apice fusco nebulosis.

?*Odyn. dædaleus* HARRIS Cat., 1833, p. 589, undescribed.

Odyn. tigris SAUSS. Revue Zool., IX, 1857, 273.

?*Odyn. pertinax*¹ SAUSS. Et. Vespides, III, 1854, 216, 108, ♂.

Odyn. cervus SAUSS. Rev. Zool., X, 1858, 165.

♀. Total length, 11 mm.; wing, 8 mm.

♂. Total length, 8 mm.; wing, 6 mm.

♀. Small. Form very slender, much lengthened, but depressed, not cylindrical. Clypeus pyriform; coarsely punctured, terminated by a little border, hardly concave, but appearing at times as if bidentate, because of a black and shining depression. Thorax much lengthened, prothorax scarcely retracted before, edge delicately upturned; its angles not spinose. Anterior portion of mesothorax often presenting a little smooth line and the posterior part two grooves. Scutel flat. Post-scutel arcuate on its posterior border. Metathorax having its hinder plate clearly marked, its surface dull subrugose, formed of two plane inclosures of a pentagonal shape, very angulate,

¹ Small male, not easy to determine.

bordered by very sharp and trenchant ridges, not arcuate, but straight and forming on each side an acute spiniform angle. The latero-superior borders of the plate are straight, salient, terminated above by an elevation which is separated from the post-scutel by a kind of notch or feeble fissure. Upon the sides of the metathorax, the ridge is prolonged by a wide and indistinct furrow (in other words, the latero-superior faces of the metathorax are feebly and widely channelled along the edge which borders the posterior side); the superior medial ridges which form the re-entering angle are less strongly pronounced. Abdomen depressed. Head and thorax densely cribose. Superior face of the metathorax very rugose.

Insect black. A spot at the base of the mandibles, another upon the front, a point behind the eyes, the anterior border of the prothorax, a spot below the wings, the posterior border of the post-scutel and two spots on the posterior border of the scutellum, yellow. Clypeus either with four yellow spots, or yellow with a black square, or bordered with yellow. Antennæ black, ferruginous beneath, with a yellow line upon the scape. Segments of the abdomen all ornamented with a regular yellow border; the borders of 3d and 4th often very narrow and the 5th wanting. Feet black, tibiæ and tarsi yellow, these last often orange. Wings transparent, washed with brown-violet toward the end; wing scales yellow, with a brown dot.

♂. Smaller, having the form equally slender, although the thorax may be shorter. Coloration the same, but in general the border of the scutellum presents but two yellow dots, while the post-scutel is black, or also marked with two yellow points. Head large; eyes much swollen; clypeus lengthened, pentagonal, terminated by two teeth, entirely yellow, as well as the mandibles. Angles of the prothorax dentiform. Legs entirely yellow, the femora at times marked with black above; coxæ spotted with yellow. Antennæ very large and *very thick*, orange beneath, terminated by a ferruginous hook, or they are wholly ferruginous upon the last two articles.

Observation.—There exist some quite singular differences in the form of the males. In general, the thorax is less lengthened than in the ♀. The teeth and metathoracic ridges are also subject to vary within certain limits, being often blunted. When the last segments of the abdomen are retracted, the insect

loses its slender appearance. The first segment of the abdomen is often quite strongly punctured and even sometimes divided by a groove. We possess many males of very small size (length 6-7 mm.) and quite slender, taken by Edward Norton in the environs of New York and in Massachusetts, which offer very slender yellow markings, and in which the metathoracic ridges are quite blunted. One, however, recognizes them by their enlarged antennæ, yellow beneath at the extremity. With this species the bordering of the prothorax is narrow, a little bilobed, terminating in a point on each side. Sometimes the metathorax is but little angulate, while the superior ridges are also more arcuate.

Res. a. diff.—This species is recognized by its form, very slender and elongate, but yet different from that of *O. fulvipes*, in that the thorax is flattened above and the abdomen beneath, as with the *O. capra* and its congeners, not cylindrical as with the *O. fulvipes* and its neighbors. In its livery it resembles the *O. campestris*, but is distinguished from it by its very much more slender form, by the very sharp ridges bordering the metathorax, by the first segment having the border not enlarged upon the sides, etc. The very small males could be easily confounded with those of the *O. Philadelphicæ*, but can be easily distinguished from them by the wide and short form of the superior face of the first segment and by the absence of its great longitudinal groove.

Hab. The United States. Canada. (Lake Superior.) Connecticut. New York. Pennsylvania. Illinois. Louisiana. The Prairies. (Fort Tejon.) (14 ♀, 10 ♂.)

9. *A. ambiguus* SPIN.—Niger, punctatus; metanoto rugoso, excavato, acute marginato, utrinque angulato; antennis subtus rufis; pronoti margine antico, macula subalari, et scutelli, abdominis segmentorum 1ⁱ, 2ⁱ margine postico, luteis; secundo subtus basi tuberculato; alis rufescentibus, apice griseis, tegulis flavo-marginatis; ♂ clypeo flavo, tibiis et tarsis rufis; scutello et pleuris nonnunquam immaculatis.

Odyn. ambiguus SPIN., Gay's Hist. fis. de Chile, Zool., VI, 264, 9 (1851)

♀.—SAUSS. Vespides, I, 140, 23, ♀.

Odyn. Bustillosi SAUSS., Gay's, Chili, ibid. 567, 10, ♂.—SAUSS. Vespides, I, 141, 25, ♂; III, 205.

♀. Total length, 9.5 mm.; wing, 6.5 mm.

♂. Total length, 7 mm.; wing, 5.5 mm.

Small, black; head and thorax densely punctate. Head rounded; the antennæ inserted a little lower than the middle of face. Clypeus rounded, convex, slightly bidentate at the apex; angles of prothorax sharp. Post-scutel transverse, a little elevated, rounded and rough. Metathorax roughened above; its posterior face excavated, with sharp edges, and bidentate on each side; the lateral tooth or angle placed rather lower than the middle of the metathorax; the excavation smooth. Abdomen very little punctured; the first segment anteriorly truncate and smooth; the suture angulate; the upper face with shallow punctures and parted by a slight groove; second segment slightly constricted at base, tuberculate at base beneath.

Antennæ ferruginous beneath. A little dot behind the eye, anterior edge of prothorax, a spot below the wing, the posterior margin of scutel, and of the first two abdominal segments, sulphur-yellow or whitish. Wings subhyaline; the costal part and base washed with ferruginous.

♀. Clypeus more triangular, strongly cribose, black. Wing scale yellow, with a brown spot. Feet black; tarsi and anterior tibiæ rather ferruginous beneath.

Var. Clypeus with an interrupted yellow band and two yellow spots or with yellow spots only.

♂. Clypeus yellow, tenuously margined with black. Hook of the antennæ very small. Knees, tibiæ, and tarsi ferruginous. Spot under the wing small. Wing scales black, margined with yellow. The yellow fasciæ of scutel narrow or interrupted.

Var. No spot under the wing; scutel entirely black, mandibles passing into a pale color.

Res. a. diff.—The male rather differs from the female, so that I first thought them to be different species; however I have no doubt as to their identity, having been able to compare 8 ♀, 9 ♂.

Hab. Chili. In the woods.

B. Form still lengthened, but less slender.

10. A. capra SAUSS.—Validus, gracilis, niger, punctatus; antennis subtus ferrugineis, scapo fascia flava; metanoti foveola polita, punctata, acute marginata, per carinam divisa, angulata, ♂ utrinque in dentem lateralem excurrente; clypei maculis 2 vel 4, puncto frontali et post-

oculari, macula subalari, punctis 2 scutelli, pronoti margine et abdominis vittis 4 vel 5, ♂ 6, tibisque sulfureis.

♀. Total length, 17 mm.; wing, 13 mm.

♂. Total length, 14 mm.; wing, 10 mm.

Odynerus capra SAUSS. Rev. Zool., IX, 1857, 273.

Form quite slender as with the *O. unifasciatus*, but of larger size. Head and thorax cribose with moderately dense punctures. Clypeus widely pyriform, convex, punctured, terminated by a border almost straight, but impressed and smooth in the middle, so that it even appears a little bidentate. Head and thorax densely punctured. Vertex offering at times a double impression toward the middle of the posterior border. Thorax lengthened; angles of the prothorax feebly indicated; metathorax having two or four longitudinal grooves. Post-scutel large, a little truncate, but without any sharp ridge, slightly bossed, and cribose with punctures as far as the trench; metathorax rugose; its posterior part wide, shining, punctured, and bordered all around by a salient cordon which forms at the summit two distinct angles and upon each side an angle, at times subdentiform; this plate beyond divided by a medial carina into two pentagons. Abdomen a little depressed, finely punctured, more distinctly upon the 1st segment and on the border of those following, but the borders not channelled nor upturned; the first segment distinctly truncate, its suture very salient; its superior face trapezoidal, as with the *O. unifasciatus*, but wider and shorter.

Insect black, clothed with a grayish or ferruginous pile. A spot at the base of the mandibles, two arcuate spots on the summit of the clypeus, a dot on the front, and another behind each eye; two triangular spots forming a bilobate border on the prothorax terminating in a dot upon each side; a spot beneath the wing and two upon the scutellum, yellow. Antennæ black, with the flagellum beneath ferruginous or yellow, and carrying a yellow line upon the scape before. Wing scale spotted with black, with brown and with yellow. Abdomen shining; its segments 1-4 or 1-5 regularly bordered with yellow. Feet black; tibiæ yellow, at least above; tarsi brown or ferruginous. Wings transparent, feebly washed with brown along the nervures and in the radial.

Var. Two yellow spots at the base of the clypeus. Clypeus yellow with a black dot in the middle.

♂. Clypeus strongly bidentate, polygonal, and with the labrum and the mandibles before, yellow. Hook of the antennæ very small, black. Border of the concavity of the metathorax much more salient; its superior angles elevated into two pyramids separated from the post-scutellum by two fissures. Lateral angles of the metathorax prolonged in the form of a spine-like tooth. Segments 5 and 6 adorned with a narrow yellow edging; knees, tibiæ, and tarsi yellow.

Var. ♂. No yellow spots beneath the wing nor on the scutellum (Illinois, Wisconsin).

Observation.—The markings upon this species are of a sulphur-yellow. The first two segments of the abdomen have a regular border; that of the first is at times a little enlarged in the middle. The bordering of the segments 3–5 is but a narrow edging.

This *Odynerus* is literally the American representative of the *O. antilope* of Europe. It has the same form, the same sculpture, the same design, and cannot be distinguished but by the less developed yellow ornaments and by a little larger size.

Res. a. diff.—This species is especially characterized by the form of the metathorax, the plate of which is shining as with the *O. antilope*, and has the inferior borders more salient. It is distinguished also by its great size, by its form, lengthened but not narrow, by the regularity of its abdominal bands, and by its livery of yellow ornaments, but little developed and constant. It differs from the *O. unifasciatus* by its large size, by its 2d abdominal segments having the border not upturned, by its numerous yellow bands.

Hab. North America, the eastern portion, where it is very common. I possess 20 of the ♀ and 4 ♂, which have been taken in Canada, Lake Superior (Agassiz), Connecticut (Norton), Pennsylvania (Rathvon), Tennessee (Fuchs), Illinois (Walsh), Missouri, Louisiana (Norton).

11. A. Spinolæ SAUSS.—Validus, niger, nitidus, punctatus, statura et formis *O. capræ* simillimus, at metanoti disco ♀ magis acute marginato supra angulosiore; clypeo, scutello et thoracis lateribus immaculatis;

abdomine tantum fasciis 2 flavis; prima latissima, nigro emarginata, secunda angusta; alis fusco-violaceis. ♀.

Odynerus Spinolæ SAUSS. Vespides, III, 216, 107 (1854).

Total length, 16 mm.; wing, 12 mm.

♀. Large, clypeus widely pyriform, coarsely cribose, terminated by a little, almost straight, and appearing bituberculate, border. Ocelli large and approaching; upon the vertex a little woolly space. Thorax lengthened. Prothorax neither angulate nor rimmed, having the shoulders only lightly defined. Disk of the mesothorax wide, bearing four longitudinal grooves and a fifth quite feebly marked which occupies the middle of its anterior part. Post-scutel short and truncate, cribose, and rugose, almost forming a ridge. Concavity of the metathorax surrounded by a salient and trenchant border, forming on each side a sharp spiniform angle and on the summit two yet more distinct angles, separated from the post-scutellum by a groove; the posterior plate divided into two pentagons by a medial carina. Suture of the first abdominal segment very decided; border of the second segment smooth, having no larger punctures than upon the remainder of it; those of the following segments strongly punctured. Head and thorax shining, cribose, with separated punctures, metathorax rugose.

Insect of a shining black, clothed with a gray ferruginous pile; a spot at the base of the mandibles, one between the antennæ, a dot behind each eye, and two triangular spots on the prothorax, yellow. Antennæ black, ferruginous, or yellow beneath, their scape marked with a yellow line. First abdominal segment entirely yellow above, behind the suture, with a black depression of variable form in the middle; second segment ornamented above by a narrow yellow border, at times badly limited, slightly mingled with the black, a little interrupted or passing into brown. Feet black; tibiæ and tarsi yellow. Wings of a transparent brown; with dark violet reflections; wing scales brown or black, with a yellow dot. The ornaments are of a lively yellow.

Res. a. diff.—This species is easily recognized by its large size, its violet wings, the wide border of its first segment, and that of the second segment at times retracted in the middle and its black clypeus. It is easily distinguished from the *O. unifasciatus* by its very angulate metathorax and by the border of the second segment, which is not rugose.

It has exactly the size and form of the *O. capra*, but is distinguished from it by its metathoracic plate having sharper angles, by its more truncate post-scutel, and by its second abdominal segment being less punctured along the border; perhaps also by its violet wings and the absence of spots beneath the wings and on the scutellum, and by the absence of yellow bands upon the 3d and 4th segments. It is distinct from the *O. unifusciatus* by the border of the 2d segment, which is neither channelled nor rugose.

Hab. The United States. Connecticut. Pennsylvania. Indiana. Illinois. Tennessee. (6 ♀.)

C. Body more gathered (not so elongate), normal, but the thorax is still sensibly longer than wide.

c. Metathorax destitute of strong spines.

12. *A. albophaleratus* SAUSS.—Medius, niger, punctatus; puncto frontali et post-oculari, pronoti et abd. segmentorum margine, maculis 2 scutelli, 1 subalari, tegulisque, niveis; ♀ clypeo albido-bimaculato, et antennarum scapo subtus testaceo; ♂ mandibulis, clypeo bispinoso lineaque scapi et pedibus albidis; pronoto et metanoto bidentato.

Odynerus albophaleratus SAUSS. Vespides, III, 217, 109.

♀. Total length, 13 mm.; wing, 10 mm.

♂. Total length, 10 mm.; wing, 8 mm.

♀. Size moderate. Head and thorax densely punctured. Clypeus widely pyriform, punctured, terminated by a little straight or subemarginate border. Thorax mediocre; prothorax moderately wide; its angles distinct; mesothorax marked with four grooves at its base, with two across the whole; metathorax rugose; its posterior plate finely shagreened; bordered by a cordon which marks out the usual pentagon, which is but little angulate, without lateral teeth. Abdomen ovalo-conic; the first segment wide and truncate with a very distinct suture; the whole abdomen quite finely punctured; the 1st segment most strongly.

Insect black. A spot upon the front, another behind each eye; a slender border on the prothorax, two dots on the scutellum, and a regular border on every segment of the abdomen, whitish. Antennæ black; the scape testaceous beneath. Legs black, the tibiæ white above; tarsi slightly ferruginous. Wings transpa-

rent, with the radius and the stigma brown, except a little washing of brown ferruginous about the nervures.

♂. Clypeus lengthened, bidentate; the teeth permitting between them a narrow emargination. Mandibles, labrum, clypeus, and a line on the scape of the antennæ, white. Extremity of the antennæ beneath and the hook, ferruginous. Angles of the metathorax dentiform; marginal ridges of the metathoracic plate very trenchant, forming on each side a spiniform tooth; scutellum parted by a groove; post-scutel rugose, offering on the summit of its posterior trench a sort of interrupted rugose ridge. Knees, tibiæ, tarsi, and often the femora, whitish.

Var. Scutellum bordered with whitish.

Res. a. diff.—This species is very well characterized by its white ornaments, and it has the appearance of the European species of the subgenus *Epipona*. One might easily err in ranging it with this group in spite of the anteriorly truncated abdomen. The clypeus (♂) in particular is cut exactly as with these insects. See the affinities of the *O. Catskilli*.

Hab. North America. I took this *Odynerus* in abundance in the environs of New York in the month of April, but I met none except the males. I finally received 12 ♀ from Connecticut, Illinois, and Pennsylvania.

Observation.—We possess one individual ♀, having the form sensibly more stubbed, which has the clypeus white, with a black spot and the scutellum almost entirely white; the borders of the segments quite wide. (Illinois.) Is it a simple variety?

13. A. Catskillensis SAUSS.—*Niger, punctatus, crassus; O. albo-phalerato* statura et *O. campestri* picturâ similis; corpore flavo-picto; metanoti foveola acute marginata, frequenter utrinque macula flava; scutellorum limbo interrupto, flavo; antennarum scapo flavo-lineato.

Odynerus Catskilli SAUSS. *Vespides*, I, 126.¹

Odyn. Catskillensis SAUSS. *Et. Vespid.*, III, 204.

♀. Total length, 11.5 mm.; wing, 9.5 mm.

♂. Total length, 9.5 mm.; wing, 8 mm.

¹ The fig. 8, pl. xvi, which is named as representing this species in the work cited, does not represent it at all. It is a lapsus to be regretted, without considering that the figure is very bad. One should not take it into account at all.

♀. Form stout. The size and shape of the *O. albophaleratus*, but the thorax is shorter. Clypeus wide, quite triangular, truncated at the extremity or appearing lightly bidentate, strongly punctured. Body densely punctured and clothed with a gray pile. Concavity of the metathorax dull, finely wrinkled, strongly bordered; its marginal ridges arcuate and quite strongly salient at the summit, where they almost form two little teeth separated from the post-scutel by a fissure; on each side there is formed another dentiform angle, at times not very decided. Abdomen short; the first segment short; almost as wide as the 2d.

Insect black, much resembling in coloration the *O. campestris*. Antennæ ferruginous beneath, with a yellow line upon the scape. A dot upon the mandibles, four spots upon the clypeus, one on the front, one behind each eye, a narrow border on the prothorax, a spot beneath the wing, an interrupted bordering on the scutel, and two arcuate spots upon the lateral ridges of the metathorax, yellow. All the segments of the abdomen adorned with a narrow, regular border; knees, tibiæ, and tarsi yellow; these last often ferruginous. Wings transparent, washed with brown in the radial and along the nervures. Wing scales yellow, touched with brown.

Var. a. Clypeus yellow, with a black spot.

b. Only four yellow borders upon the abdomen.

c. Spots of the metathorax very small, occupying the base of the ridges.

d. No spots on the metathorax.

♂. A little smaller, stubbed. Mandibles, labrum, and clypeus yellow; this last wide, rounded, and bidentate. Hook of the antennæ ferruginous, as well as the extremity of the flagellum beneath. Border of the 1st abdominal segment often blended upon the sides with a yellow dot; femora yellow; feet almost entirely yellow. Two yellow dots on the sides of the 2d segment.

Var. a. No separate yellow dots upon the 2d segment.

b. Scutels black.

Res. a. diff.—This species can be recognized by the short first abdominal segment, as wide as the 2d, and by the two yellow spots on the metathorax. But this last character being subject to be wanting, it is not advisable to give it too much importance. One can distinguish this *Odynerus* from the *O. capra* by its very much smaller size and by its stubbed form: from the *O. Spinolæ*

by its smaller size, its less angulate metathoracic plate, by the narrow border of the first segment, by the transparent wings and quite different livery: from the *O. albophaleratus* by its yellow ornaments; its shorter thorax, a little less strongly punctured, its abdomen having more punctures, its antennæ more colored, and the size a little larger: from the *O. unifasciatus* and *campestris* by its metathoracic plate bordered throughout by sharp ridges and by the border of the 2d segment which is not rugose. But above all it might be confounded with the *O. birenimaculatus*. It is distinguished from it by the less rich livery, by the regular border of the first segment, by the very much less gross form, by the much smaller size, etc. Compare these two species carefully.

Hab. The United States. New York. Connecticut. Illinois. (10 ♀, 5 ♂.)

Observation.—This species is the American representative of the *O. renimacula* and it appears to me to differ from this species only by the rather less defined angles of the prothorax and by the metathoracic plate, which is not striate.

I possess a very small individual, ♀ (long. 8 mm.), which perhaps indicates the existence of another allied species. The thorax is a little more lengthened, the first segment of the abdomen is divided by a feeble groove, the clypeus offers but two yellow dots toward the base, and the metathoracic ridges are marked by two little yellow lines. (Connecticut, Mr. Edw. Norton.)

I possess also many more little males which I cannot but ascribe to this species and which, in fact, do not present any difference from the males of the normal size, but in being much smaller, and that some of the punctures of the first segment of the abdomen are a little stronger. Length, 8.5 mm.; wing, 7.

These specimens have no separate spots on the 2d abdominal segment. The 1st segment carries a regular border, not enlarged upon the sides. The scutellum offers two yellow spots; the post-scutel is in general black, at times bipunctate.

I do not doubt but that these little males really belong to this species, just as one often meets variations among the insects of this group. These males greatly resemble those of the *O. tigris*, but they are however larger, and above all, wider and more stubbed in form. Connecticut. New York. Illinois.

14. *A. adiabatus* SAUSS.—Minutus, niger; clypeo ♂ tenuiter bidentato; metanoto bispinoso, superne rugoso, haud acuto; abdomine gracili; primo segmento elongato; clypeo, mandibulis, scapo antice, puncto frontali et post-oculari, pronoti linea antica, tegulis, puncto subalari abdominisque segmentorum marginibus anguste, flavis. Pedibus flavis, femoribus nigris; alis subhyalinis. ♂.—Long. 8 mm.

Odynerus adiabatus SAUSS. Vespides, I, 138, 26, ♂ (1852).

Hab. North America. Carolina. (Type in the Paris Museum.)

15. *A. fastidiosusculus* SAUSS.—Niger, clypei summi fascia arcuata utrinque, macula frontali et post-oculari, scapo subtus, pronoti margine, tegulis, fascia interrupta scutelli, fascia post-scutelli, macula subalari abdominisque fasciis 4, flavis; fascia primi segmenti utrinque dilatata; pedibus basi nigris; alis subhyalinis. Long. 10 mm. ♀.

Odynerus fastidiosusculus SAUSS. Et. Vespid., I, 137, 19, ♀.

Hab. Brazil. (Type in Paris Museum.)

16. *A. Santa-Annæ* SAUSS.—Niger, densissime punctulatus, clypeo grosse cribrato; pronoto subangulato; metanoti foveola acutissimo marginata, bidentata; abdomine subvelutino, ovato; puncto frontali et post-oculari, litura angusta pronoti abdominisque vittis 3, flavis; alis ferrugineis;—♀ clypeo atro flavo bipunctato, antennis atris, macula subalari et 2 scutelli, flavis;—♂ clypeo, subbidentato, flavo, scapo flavo lineato.

Odynerus Santa-Anna SAUSS. Revue et Magas. de Zool., IX, 1857, 273.

Total length, 10 mm.; wing, 11 mm.

♀. Clypeus pyriform, truncate, or feebly subbidentate, very coarsely punctured. Prothorax not retracted before; its angles distinct. Mesothorax with a little smooth carina before; its grooves moderately pronounced. Post-scutel truncate, offering a feeble ridge at the summit of its posterior face; this ridge interrupted and finely crenulate. Plate of the metathorax triangulate, very clearly bordered all around by very trenchant straight ridges, which inclose the two pentagons in a very distinct manner. The lateral angles dentiform; the superior ones acute. Abdomen punctured, ovate; the first segment narrower than the 2d, punctured, having a very strong suture. Border of the 2d and the following segments densely punctured, but neither rugose nor channelled. That of the first offering a punctured line.

Head and thorax finely and very densely shagreened; abdomen punctured, a little velvety.

Insect black, covered with gray hair. Two lateral spots on the summit of the clypeus; another between the antennæ, a dot behind each eye, a narrow border on the prothorax, a spot beneath each wing, two on the posterior border of the scutellum, two dots on the wing scales, and the border of segments, 1, 2, 3 of the abdomen, sulphur-yellow; there is often a yellow dot at the base of the scape of the antennæ and upon the anterior tibiæ. The yellow bands of the abdomen are regular; the first often slightly enlarged at the two extremities, the two others at times retracted in the middle, and complete beneath. Wings transparent, washed with brown ferruginous. Wing scales black, spotted with yellow.

Var. Clypeus and antennæ black.

♂. Size same as the female. Clypeus yellow, armed with two short teeth separated by a semicircular emargination; its inferior margin finely bordered with black; mandibles and labrum black. Scape of the antennæ in general marked with a yellow line; hook black. Wing scales, scutellum, and the flanks, in general, black, without yellow spots; the fourth segment carrying a narrow yellow band interrupted above. Tibiæ yellow before. Post-scutel divided by a little medial groove. The superior angles of the metathoracic plate pronounced.

Res. a. diff.—This species is peculiar in its wholly black antennæ and in a very marked tendency to lose its yellow ornaments. Its thorax is short and little arched. Its abdomen has a velvety appearance. It has the form of the *O. Catskillensis*, but the first abdominal segment and the thorax are a little less wide; its size is a little greater. The ♂ has the clypeus sensibly less bidentate than the North American species of this group. It is closely allied to the *O. Bustamente*. (See the description of this species.)

Hab. The hot and temperate regions of Mexico. Cordova. Jalapa, the Michoacan.

17. A. Bustamenti SAUSS.—*O. Santa-Annæ* simillimus, niger; clypeo integro maculis 4 flavis; thorace latiore, pronoto latissimo, tenuiter flavo marginato, metanoto angustiore, canthis inferis flavo-ornatis; macula subalari et scutelli fascia interrupta, flavis; abdomine velutino, basiliato, segmentis 1-5 flavo-marginatis; tegulis flavo-bipunctatis. ♀.

Odynerus Bustamente SAUSS. *Revue et Mag. de Zool.*, IX, 1857, 273, ♀.

Total length, 11 mm.; wing, 9 mm.

♀. A species closely allied to the *O. Santa-Annæ*, having exactly the same appearance and the same sculpture; the abdomen being also of a deep velvety black.

Clypeus wider than long, its anterior border truncate, straight, or a little concave, not bidentate. Thorax very short, sensibly wider than with the species cited; the prothorax less angulate, but very wide, the disk of the mesothorax wider than long; its grooves indistinct; metathorax a little retracted, so that the thorax increases in width from behind forward. The posterior plate of the metathorax a little striate, wider and less strongly bordered. The yellow ornaments more abundant than in the preceding species; clypeus carrying four yellow spots, or yellow with the scutellum black on the summit; scape of the antennæ adorned with a yellow line; border of the prothorax very narrow. Thorax with a spot beneath the wing, an interrupted band on the scutellum, and with two spots upon the inferior edges of the metathorax. Segments of the abdomen all regularly bordered with sulphur-yellow; the last ones very narrowly; the first ones very short, as wide as the second. Feet black, tarsi and tibiæ ferruginous. The remainder as with the *O. Santa-Annæ*.

Var. Two yellow dots on the scutellum.

♂. Unknown.

This species very much resembles the *O. Catskilli*, but differs from it by the very punctate border of the abdominal segments, the first segment being also wider and shorter.

Hab. The cold regions of Mexico. I have taken this *Odynerus* upon the Coffre de Perote.

18. *A. Sylveiræ* SAUSS.

Odynerus Sylveiræ SAUSS. Et. Vespides, III, 217, 110; pl. x, fig. 8, ♀ (1854).

Hab. Brazil. *Sylveird.* (Type in the Paris Museum.)

b. Metathorax having two strong spines.

19. *A. Clarazianus* SAUSS.—Niger, sericens; capite rufo vel obscuro; capite et thorace superne rugose punctatis; pronoti angulis emarginatis, lobatis; post-scutello valde cristato, emarginato; metathorace postice excavato, canthis peracutis marginato, utrinque spina et infere dente armato; antennis nigris; pronoti margine postico, tracula subalari,

tegulis, fascia scutelli et post-scutelli, metanoti angulis adominisque segmentorum 1-3 margine, pallide flavis; alis antice fusco-marginatis.
♂. Clypeo bidentato luteo.

Anc. Clarazianus SAUSS. Rev. de Zool., 1870, 55, 3, ♀ ♂.

♀. Total length, 12 mm.; wing, 10 mm.

♂. Total length, 10 mm.; wing, 8 mm.

♀. Body stubbed. Head rather large, the vertex transverse, not convex; ocelli set in depressions. Thorax slightly convex; prothorax having each of its angles extended into a lamellar rounded process, which is separated from the anterior margin by a wide notch. Disk of mesothorax parted by a longitudinal groove, and posteriorly bicarinate; the carinæ sinuous, terminating at the angles of the scutel. Scutel parted by a groove and separated from the mesothorax and post-scutel by deep furrows. Post-scutel truncate, elevated into a high crest, rather concave behind; the crest broadly emarginate, forming two nearly triangular lamellar teeth. Metathorax much excavated, margined with very sharp edges; the lateral angles produced into strong spines, the upper arcuated edges very salient, rather crested; the inferior edges forming on their lower part, each a triangular tooth. Head and thorax above coarsely and roughly punctate; thorax on the sides and behind finely punctate and covered with silky, silvery pile. Abdomen short, finely punctured, silky, with gray-golden reflections, the first segment nearly as wide as the second, short, its suture transverse, very distinct.

Black. Antennæ black, the 1st and 2d joints rufous beneath; head and mandibles rufous or orange-red, about the antennæ and a little on the vertex black. Anterior margin of the prothorax very delicately rufous; posterior margin of prothorax, a spot beneath the wing, a band on the scutel and one on the hinder part of post-scutel, the angles of metathorax, and the inferior edges, pale yellow; the crest of post-scutel also yellow, finely margined with black on its hinder face. Tegulæ rufous, margined with pale yellow; the process next to them yellow. The first three abdominal segments adorned with a regular yellow margin; the first narrow, fusing on each side into a little lateral spot; the second widest, the third narrowest. Feet brown or passing into ferruginous; tibiæ, the 1st and 2d anteriorly, and the extremity of 2d femora, marked with yellow. Wings hyaline; anterior margin and radial cell brown.

Var. The head more or less obscure, passing into black or quite brick-red.

♀. Clypeus pyriform, coarsely punctate, terminating with two small brown approximating teeth.

♂. Head blackish or black; orbits rufous; inner margin of the eyes, a frontal spot, and a line on the mandibles, pale yellow; the scape at times with a yellow line; clypeus polygonal, strongly bidentate, pale yellow. Anterior femora and tibiæ yellowish before (Bahia Blanca).

The male is described from a southern specimen, which may be the reason of its black head. Specimens from Buenos Ayres may have the head red like the females?

Res. a. diff.—This is a quite distinct species in the form of the thorax. It has also a different appearance from all other *Ancistrocerus*.

Hab. The Argentine Republic, 5 ♀, 4 ♂. Buenos Ayres (Meyer Dürr), 1 ♀, 3 ♂. Bahia Blanca (G. Claraz).

D. Form very stubbed. Thorax cubical, nearly as long as wide.

20. A. birenimaculatus SACSS.—Crassus et brevis; tenuiter punctatus; clypeo flavo, ♀ truncato, ♂ bidentato; thorace brevi, quadrato; metanoti foveola acutissime marginata, utrinque et superne angulos dentiformes efficiente; macula frontali et post-oculari, fascia in scapo antennarum, pronoti limbo late, tegulis, scutello, post-scutello macula subalari et utrinque metathoracis pedibusque, flavis; abdomine lato, conico, segmentorum margine punctato, late flavo-limbato, secundo sæpius utrinque macula flava; primi fascia utrinque antrorsum dilatata.

Odynerus birenimaculatus SACSS. *Vespides*, I, 135, 16, ♀, var.

Total length, 14 mm.; wing, 11 mm.

♀. Large and *very stubbed*. Form very short and very wide. Clypeus wider than long, truncate, finely punctured. Thorax stout, very wide, cubical, a little longer than wide. Prothorax not angular; mesothorax marked posteriorly with two profound grooves. Post-scutel short, truncate, having a sort of ridge, blunted in the middle. Metathorax very wide; its posterior plate wide, quite flat, finely shagreened, very angulate, and bordered all around by some very trenchant ridges, which form on each side a spiniform angle and on the summit two sharp teeth. Head and thorax very *densely* and *finely* punctured.

Abdomen wide and conical; the first segment short, as wide as the 2d, elevated at the suture; its superior surface often longitudinally striate along the suture; the border of the segment distinctly punctured; that of the 2d insensibly reflexed.

Insect black, strongly mingled with yellow. Mandibles brown at the extremity. Clypeus yellow, at times adorned with a little brown dot. Antennæ black, with the scape yellow before and the flagellum ferruginous beneath at its base. A spot on the front, one behind each eye, a wide border on the prothorax, a spot below the wing, wing scale, scutel, post-scutel, two arcuate spots occupying the angles of the metathorax, and a wide border on every segment of the abdomen, yellow; these borders regular; that of the 1st segment joined to two oblique lateral spots; the 2d ornamented on each side by an oblique spot, sometimes separated, sometimes confounded with the border. Anus yellow. Feet yellow, thighs obscure at their base; coxæ spotted with yellow. Wings transparent, a little smoky along the side and toward the end, with a light violet reflection.

Var. a. Scutellum having but one yellow interrupted band.

b. No yellow lateral spots on the 2d segment.

c. The border of the 2d segment festooned in consequence of the fusion with the lateral spots.

d. The yellow ornaments passing into orange.

♂. Same size as the ♀. Extremity of the antennæ and their hook ferruginous; clypeus bidentate. Mandibles yellow. Scutellum divided by a groove. Yellow ornaments narrower, often interrupted on the scutel; lateral spots of the first two segments small. Anus only spotted with yellow. (The border of the first segments in general regular, only confounded on each side with a yellow dot.)

Var. Size small, length 11 mm.; wing 8 mm.

Rees. a. diff.—This beautiful species is very distinct in its very stubbed form, in its size, in its cubical and *finely* punctured thorax, not cribose with holes, in the exceptional width of its yellow markings. It can, however, be confounded with the *Odynerus Catskillensis*, from which it may be distinguished by the yellow clypeus of the female, by the much richer ornamentation, by the notably more stubbed form, and by the two oblique yellow spots of the first segment which mingle themselves with the border; by the elevated and truncate post-scutel and by its superior size.

The *O. birenimaculatus* differs from the *O. Spinolæ* by its very much more densely punctured and not smooth body, by its transparent wings, by the margin of the 2d segment which is densely punctured, by the first segment which is wider, by its stubbed form, etc.; from the *O. campestris* and *unifasciatus* by the very much more densely and less coarsely punctured thorax, by the form of the metathorax, by the less coarsely punctured margin of the 2d segment, etc.

Finally, the *O. birenimaculatus* offers a great resemblance also to the *O. renimacula* of Europe, although its form is very much more stubbed than that of this last species.

Hab. New England. New York. 24 ♀, 3 ♂.

II. *The concavity of the metathorax forms no distinct lateral angles.*

Here the posterior plate is often rugose. It is at times still bordered at the summit by some ridges or one double arch; sometimes it is not limited, especially not on the sides, where it is effaced and lost in the sides of the metathorax. The concavity is often formed by the meeting of two convex facettes.

A. *Posterior face of metathorax remaining margined, but without distinct angles. Body slender, elongate.*

a. *Post-scutel strongly truncate.*

21. A. conspicuus SAUSS.—Gracilis, niger, ubique punctatus; capite et thorace crassissime et rugose punctatis; prothorace antice cristato, angulato, post-scutello valde truncato, facie postica polita; metathorace utrinque haud angulato, foveola lævi, tenuiter marginata, abdomine dense punctato; primo segmento minuto, acute suturato; antennarum scapo subtus, puncto frontali et subalari, pronoti abdominisque segmentorum 1, 2 limbo postico, fascia interrupta scutelli, fascia post-scutelli, lineaeque femorum intermediorum, luteis. ♀.

Ancistrocerus conspicuus SAUSS. Rev. et Mag de Zool., IX, 1857, 247.

Total length, 9.5 mm.; wing, 7 mm.

♀. As slender as a *Stenancistrocerus*. Head and thorax very roughly punctured. Clypeus very coarsely punctured, finely bicarinate at tip and minutely bidentate. Head margined posteriorly. Vertex having a tubercle garnished with an erect brush of hair. Thorax scarcely contracted posteriorly, very square

anteriorly; the prothorax with a crested margin, its angles dentiform, acute. Post-scutel very short, strongly truncate; its posterior face flat, polished; its superior face rough, transverse; its posterior ridge very finely crenulate, the middle with a very small compressed tubercle. Metathorax coarsely cribose, silky-grayish, its hinder face widely excavated, as polished as the posterior face of post-scutel, somewhat punctate, finely margined; the margins forming behind the post-scutel two quite small erect teeth (not easy to distinguish); no distinct lateral angles. Abdomen slender, slightly depressed; the first segment small, shortly and quite sharply truncate anteriorly; the suture elevated; its superior face short, rather strongly punctured; 2d segment not quite so strongly punctured, its hinder margin with a line of punctures, the following segments densely punctured.

Black; grayish-silky. Mandibles partly fulvous; antennæ ferruginous beneath, scape yellow beneath. Two dots on the summit of clypeus, a frontal spot, and post-ocular line, pale yellow. Hinder margin of prothorax with a narrow luteous band; its angles, appendix of wing scale, a spot under the wing, an interrupted fascia on scutel, a transverse line on the hinder face of post-scutel, and two large maculæ on the hind face of metathorax, pale yellow. The first two abdominal segments narrowly margined with luteous. Intermediate femora with a luteous line. Anterior tibiæ and tarsi brown or ferruginous. Wings hyaline, smoky, nerves and anterior margin of the apex fuscous; the 2d recurrent nerve falling nearly upon the 2d transverse cubital vein.

Var. Anterior margin of prothorax also margined with luteous.

Res. a. diff.—This is quite a distinct species and a peculiar type, making a sort of transition to *Stenodynerus* by its slender form, and its punctate abdomen, having the 1st segment more punctured than the second. The form of the scutel, post-scutel, and metathorax is quite unusual, and the very coarsely punctured thorax makes it at once distinguishable.

Its livery much resembles that of the *A. Fariasi*, but it differs from this in all its form and its punctures; in the first segment being very short and truncate, its superior face quite transverse; the scutel truncate, not triangular; the punctures of thorax and head being much coarser, etc. It has also a resemblance to *O. (Stenodynerus) totonacus*.

Hab. The temperate parts of Mexico. I caught a ♀ near Cordova.

b. Post-scutel not truncate, angulate posteriorly.

This type has the post-scutel formed much as in *Stenancistrocerus*, but the form of the abdomen remains as in the division *Ancistrocerus*, and the appearance remains also as in this group, so that we have to leave it in the division *Ancistrocerus*, prop. dict.

22. A. cingulatus SAUSS.—Gracilis, niger, nitidus, sulfureo-pictus, pronoti angulis in processus 2 productis, antennis subtus et basi flavis; abdominis segmentis 1, 2 late flavo-marginatis; primo antice truncato, sutura prominula, fascia flava utrinque aucta marginato.—♀ ♂. Clypeo truncato, flavo.

Odynerus cingulatus CRESSON, Hymen. of Cuba, Ent. Proc., Phila., II, 1865, 162, ♀.

♂. Total length, 9 mm.; wing, 7.5 mm.

♀. Total length, 12 mm.; wing, 9 mm.

Rather small. Form slender, elongate. Head and thorax punctured. Angles of prothorax strongly produced into blunt processes. Scutel and post-scutel flattened, the former parted by a deep groove. Metathorax rounded, rather roughly punctate; its concavity strigose; bordered by a rather distinct salient line, but its angles obsolete and destitute of teeth. Abdomen delicately punctured, most distinctly on the first segment and the border of the others; 2d segment somewhat swelled above; the first segment narrower than the second; its suture elevated.

Shining black. Antennæ black, with their first two joints and the under side yellow. A triangle on the forehead, a line behind the eye, a broad fascia on the edge of prothorax, a spot under the wing, the scutel, and post-scutel, yellow. The first two abdominal segments with a broad yellow margin; the fascia of the first widened on each side. Feet yellow; coxæ and hinder femora except at tip, black, intermediate coxæ yellow anteriorly. Wings clouded, principally at the end; the anterior margin as far as the stigma ferruginous.

♀ ♂. Clypeus polygonal, longer than wide, yellow; its inferior border narrowly truncate, tenuously margined with black. Mandibles dentate; ferruginous, or yellowish, black at base and tip.

Hab. Cuba. Sent to me by Dr. Gundlach.

This species is very distinct, but by its appearance might be confounded with *O. Havanensis*, which has quite a differently formed abdomen, having the angles acute, but not so much produced, and the clypeus notched.

Its slender form makes it resemble *O. tigris*, although it is very different in the produced angles of prothorax and rounded metathorax.

B. Metathorax not distinctly marginate. Body not slender, of normal form.

a. Abdomen nearly conical. The border of the 2d segment not reflexed. Body velutinous.

23. A. Parredesi SARSS.—Niger, velutino-hirsutus, argenteo-sericeus; antennis subtus ferrugineis; puncto frontali, pronoti medio et tegulis in margine, ferrugineis; abdominis segmentis 2-5 flavo-marginatis; secundo in margine valde punctato; alis ferrugineis, apice griseo-nebulosis.—♀. Clypeo infere ferrugineo-maculato.

Odynerus Parredesi SARSS. Rev. et Mag. de Zool., IX, 1857, 273.

Total length, 13 mm.; wing, 10.5 mm.

Appearance of the *O. nasidens*. Clypeus convex, quite finely punctured; its inferior border truncate, short, and bordered with a salient rim. Prothorax angulate: its angles almost dentiform. Metathorax having its posterior plate punctate and striate, bordered by slightly salient ridges; its superior ridges arcuate in the form of the end of an arch, not forming any superior angle, and on each side only a blunt, indistinct angle. Post-scutel blunted, punctate. Abdomen conical; the first segment wide, anteriorly truncate; its suture distinct.

Insect black, finely punctured, rather more strongly on the metathorax; all the body covered with a thick velvety pile, silvery and a little golden; the abdomen shining velutinous, with silky and golden reflections, the 2d segment quite strongly punctured along its border, but not channelled. The antennæ ferruginous beneath, as also a spot toward the base of the clypeus. A dot between the antennæ, a line in the middle of the prothorax, and the border of the wing scale fawn-colored or ferruginous. Segments of the abdomen, all except the first, adorned with a

regular yellow border. Legs black, varied often with ferruginous. Wings ferruginous with the end gray.

Var. The yellow passing into ferruginous and the ferruginous into yellow.

Res. a. diff.—This species wonderfully resembles those which form the group of the *O. nasidens*, but it is sufficiently distinct from it in the presence of the suture of the first segment of the abdomen. It is also more slender.

Hab. The temperate climes of Mexico. Valley of the Mex-tillan. 4 ♀.

b. Abdomen more ovalo-conical; the border of the 2d segment rugose or reflexed.

(Section I, *b*, SAUSSURE Vespides, I, 139.)

Group of the *Odynerus unifasciatus*.

24. *A. unifasciatus* SAUSS.—(Gracilis, niger, cribri instar punctatus; abdominis secundi segmenti margine canaliculato, subreflexo, perrugoso; antennissubtus ferrugineis; puncto frontali et post-oculari, macula biloba pronoti, post-scutello et abdominis primi segmenti margine, flavis. —♀. Clypeo flavo-bipunctato.—♂. Clypeo, mandibulis et abd. secundi segmenti, limbo, flavis.

Variat. ♀ secundo ♂ tertio et quarto abd. segmento flavo-limbato.

*Odynerus uncinatus*¹ SAY, Boston Journ., I, 1837, 286, 4. SAY's Entom. (LE COXTER), II, 766, 4.

Odynerus unifasciatus SAUSS. Vespides, I, 138, 21; III, 205.

♀. Total length, 14–15 mm.; wing, 11 mm.

♂. Total length, 11 mm.; wing, 8.

♀. Form slender. Head and thorax cribose with great separated punctures. Clypeus convex, strongly punctured, widely pyriform, terminated by two very small, near together and diverging teeth. Head strongly and densely punctured. Thorax quite lengthened, a little retracted posteriorly, everywhere strongly cribose with foraminiform punctures. Prothorax finely bordered, without angles. Mesothorax presenting two grooves on its hinder part. Metathorax very rugose above, reticulately shagreened, corrugated; its concavity quite flat, indistinctly striate and punctate, without spines on the sides, superiorly bordered by an

¹ It is evidently not the *O. unifasciatus* which Fabricius described under the name of *Vespa uncinata*, which is rather the *Monobia 4-dens*, because he says that all its markings are snowy-white, and that the size is that of the *Vespa maculata*.

arcuate trenchant ridge. Abdomen slender; first segment a little narrower than the 2d, distinctly truncate anteriorly, subpediculate at the base, with the anterior face smooth; the superior face slightly widened behind, bounded before by a strong sutural ridge, very distinct. The abdomen very finely punctured, but the 3d and following segments rather strongly so, and especially the border of the 2d segment *offering a wide zone, very strongly cribose, rugose, subchannelled, with subturned up border*. Near the margin of the 1st segment one sees also a line of punctures.

Insect black, clothed with gray-ferruginous hair. Two lateral dots on the clypeus, one behind each eye, a mark on the front, yellow or ferruginous; a bilobate spot in the middle of the prothorax and post-scutel, wholly or partly yellow. Wing scales brown. Abdomen wholly black; only the first segment adorned with a yellow border, suddenly widened on the sides (or joined with two lateral spots). Tibiæ and tarsi ferruginous or yellow; antennæ ferruginous beneath, black above, with the scape at times wholly ferruginous at the base. Wings of a transparent brown, with violet reflections, particularly obscure along the nervures.

Var. A spot beneath the wings and a border on the 2d abdominal segment, yellow.

♂. Smaller. Antennæ very large, terminated by a little hook; clypeus yellow, with a triangular notch; labrum and mandibles before, yellow; post-scutel yellow, or only bipunctate with yellow; the 2d abdominal segment a little compressed at the base, bordered with yellow; its margin a little sinuate, concave arcuate in the middle above, more or less *rétroussé*, compressed; the 3d and 4th segments often adorned with a fine yellow edging. The border of the 1st segment often presents a little of red; sometimes a little widened on the sides. With this species the ornaments are yellow-golden or sub-orange.

Var. a. A yellow dot under the wing. Border of the prothorax entire, bilobate.

b. ♂. Post-scutel black. On the abdomen only two narrow borders. (Illinois.)

c. ♂. Head and thorax entirely black; mandibles margined with yellow; 1st abd. segment narrowly, 2d very narrowly bordered with yellow. (Florida.)

Res. a. diff.—This *Odynerus* is quite easy to recognize by the *very rugose and channelled border of the 2d segment*; by the

unique bordering of the first segment, although certain females possess a second band like the males; by its obscure face; by its slender form, by its abdomen which is not briefly sessile, and the thickness of the border of the first segment of the abdomen, which causes the 2d segment to appear so subcompressed at its base. See the *O. campestris*, to which it is closely allied.

Hab. The United States. Connecticut. Illinois. Iowa. Prairies (Rio Pecos). Tennessee. North Carolina. 10 ♀; 12 ♂.

Observation.—Among the dried specimens one generally finds the abdomen extremely swelled, as if the segments had been violently distended. This peculiarity belongs especially to this species and gives it an unusual appearance.

25. *A. campestris* SAUSS.—Niger, grosse punctatus; metanoti foreola haud acute marginata, inermi, striata et grosse punctata; abdominis segmentorum 2^o-5^o margine rugose punctato; antennis subtus fulvis, scapo flavo-lineato; clypeo ♀ flavo, macula atra, ♂ emarginato, flavo; puncto frontali et post-oculari, pronoti et abd. segmentorum 1^o-3^o limbo (primi utrinque aucto), post-scutello, maculis 2 scutelli maculaque subalari, tibiis et tarsis, flavis; alis fusco-nebulosis.

Odynerus campestris SAUSS. Vespides, I, 137, 18; III, 204, ♂.

♀. Total length, 13 mm.; wing, 11 mm.

♀. Head and thorax cribose with great pits, quite visible to the naked eye. Clypeus pyriform, as wide as long, cribose with great punctures; its anterior border small, bordered, subconcave, upon the vertex often a little fossette. Prothorax unarmed, finely bordered. Mesothorax marked with two grooves; scutel flat; post-scutel short, sloping. Metathorax rounded, rugose; its concavity pronounced, but not *limited*; divided by a vertical carina which bifurcates at the summit to form two arcs which indistinctly border the cavity at the summit; the middle and the bottom of the concavity wrinkled; the summit coarsely punctured. Abdomen ovalo-conic, punctured; the first segment large, almost as wide as the 2d; borders of the segments 2-5 presenting a wide coarsely punctured zone, rugose, but not turned up; the border of 2d segment sinuous, forming a concave arc.

Insect black, clothed with a grayish pile. Antennæ ferruginous beneath. Clypeus yellow, with a triangular black spot. A line on the scape of the antennæ, a spot on the front, one behind each eye, border of the prothorax, a spot beneath the wing, wing scales, two dots on the scutel, post-scutel, and a

border upon segments 2-5 of the abdomen, knees, tibiæ, and tarsi yellow; the first segment of the abdomen having its border widened upon the sides, or rather, confounded with two lateral spots; border of the 3d much narrowed. Wings transparent, but washed with brown-violet especially along the borders.

Var. Clypeus black with four yellow spots, segments 4 and 5 of the abdomen with no yellow border.

♂. Clypeus emarginate, yellow; mandibles yellow.

I possess a male very closely allied to *A. unifasciatus* ♂, having also the margins of the 2d and 3d segments sinuous and coarsely punctured. But it differs from this species in the smaller hook of the antennæ, in the metathorax, wholly rugose; even on its concavity, which is less defined and not striate; in the first abdominal segment, which is parted by a quite strong longitudinal groove, and in the 2d segment more compressed at its base. It has the same markings, unless the prothorax has a little less of yellow in the middle. As this ♂ has the metathorax rounded and the wings slightly washed with brown, it seems that it cannot but belong to the *O. campestris*, unless it represents a species which may have escaped us.

It differs sometimes from the *O. campestris* in its scutellum deprived of spots and in the groove of the first segment which approaches to it, as well as the smallness of the antennary hook of the *Symmorphus*.

Res. a. diff.—This species has the appearance of the *O. parietum*. It can be confounded not only with the *Ancistrocerus* of this group, but with different *Odyneri*, properly speaking.

It differs from the *O. unifasciatus* in its more stubbed form, its less violet wings, the less upturned border of the 2d abdominal segment, and in its livery, more rich in yellow (spot beneath the wing, spots on the scutellum, etc.); from the *O. capra* in its metathoracic excavation without border, in its smaller size, its more obscure wings, and the strong rugosities of the border of the 2d and 3d segment, etc.; from the *O. Spinolæ*, in the same characters, except that the wings of this last species are darker.

Hab. The United States. Pennsylvania. Illinois. Carolina. Connecticut (7 ♀).

26. *A. tuberculiceps* SAUSS.—Niger, grosse punctatus, piloso-velutinus; mandibulis, clypeo, oculorum marginibus, pedibus, pronoto, tegulis, scutellis, maculis subalaribus et metanoti, rufis; antennis rufis, superne apicem versus nigris; abdomine rufo, segmentis flavo margi-

natis, 1^o et 2^o basi nigrescentibus; secundi margine perrugoso, maxime canaliculato, et reflexo; alis ferrugineis apice inquinatis.—♂. Clypeo flavo, bidentato; vertice tuberculo nitido instructo.

*Odynerus tuberculocephalus*¹ SAUSS. Vespides, I, 139, 22; pl. xvi, fig. 9, 10a.

Odynerus tuberculiceps, Ibid. III, 205.

♀. Total length, 13 mm.; wing, 11 mm.

♂. Total length, 9 mm.; wing, 8 mm.

Clypeus pyriform, strongly punctured, truncate, and subbidentate at the extremity. Head strongly and densely punctured. Behind the ocelli is a little, indistinct tubercle, shaped like a 4th ocellus. Anterior ocellus very large. Thorax cribose with large distinct points. Angles of the prothorax a little prolonged, subdentiform; scutellum divided by a groove. Concavity of the metathorax appearing punctured or rugosely striate, according to the way in which it is seen, with the borders perfectly rounded; there is only a little border at the summit in a feeble arch. Abdomen punctured; the 1st segment narrower than the 2d, bordered by a slightly salient cordon; the 2d having its margin very strongly annulate, very strongly upturned, and very rugose, a little sinuate in the middle.

Insect clothed with long gray or ferruginous hair, abdomen velvety. Head and thorax black. Mandibles, clypeus, a dot upon the front, border of the eyes, interrupted at the summit, prothorax, scutel, wing scales, two spots beneath the wings and two others on the metathorax, of a ferruginous red. Mesothorax with two red lines. Abdomen ferruginous, with the base of the second segment and the anterior face of the first, blackish. Posterior border of all the segments margined with yellow, but this color often passing into ferruginous on the last segments. Legs ferruginous; femora black or spotted with ferruginous. Antennæ red, with the second moiety black above. Wings washed with ferruginous, with the end brownish.

♂. Notably smaller. Clypeus bidentate, notched, yellow, as well as the mandibles and a line on the scape of the antennæ; the flagellum with more of black; hook very small, ferruginous. Tubercle on the vertex very much larger than that of the female, distinct and shining. Concavity of the metathorax punctured, with little or no superior border. Abdomen a little more com-

¹ Nomen mendosum.

pressed at the base of the second segment, the middle of segments 1st, 2d generally black, the red less developed. Legs often varied with yellow.

Var. The middle of the prothorax a little yellow. The black encroaching upon the red. The scutels often black, bordered with red; the metathorax also often wholly black; the sculpture of this last appears also to vary somewhat; at times the red is more developed. Metathorax red; flanks varied with red.

Res. a. diff.—Various *Odynerus*, properly speaking, are often identical in color with this. Such are the *O. Moreliæ* and *Guerrieri*, but they may be sufficiently distinguished from it by the absence of the tubercle on the vertex and of the suture upon the 1st segment.

The *O. tuberculiceps* hardly differs from the *O. Sutterianus*, but by a less brilliant livery and by its prothorax slightly retracted and angles less salient.

Hab. The temperate regions and the plateau of Mexico. I have found this *Odynerus* common in the most various localities. In the eastern Cordillera; in the valleys of Orizaba and of Jalapa, of Uvero; in the Sierra Madre; in the valley of Mextillan; in Huasteca on the Pacific slope, and in the province of Mechoacan, about Morelia, Tuxpan, Zinapécuaro, Patzcuaro, and finally on the plateau in the valley of Mexico. 16 ♀, 18 ♂.

27. A. Sutterianus *n. sp.*—Niger, *O. tuberculicipiti* simillimus; vertice tuberculato, pronoto valde biangulato; abdominis secundi segmenti margine canaliculato, rugoso, reflexo; antennis aurantiis, apice supra nigris; ore, clypeo, fascia post-oculari, frontis macula et lineolis 4, pronoto antice; tegulis, macula subalari, post-sentello, maculis 2 scutelli, tibiis tarsisque, sulfureis; abdomine sulfureo, segmentis 10, 20, basi nigris; alis ferrugineis, apice griseis.

Total length, 12 mm.; wing, 10 mm.

♀. Form and punctures exactly like those of the *O. tuberculiceps*; clypeus pyriform, finely bidentate. The same tubercle on the vertex, appearing like a fourth ocellus, but the prothorax not retracted before, more square; the angles alone very salient, diverging and prolonged, perhaps bluntly terminated, not forming a sharp spine; the abdomen a little more slender; the margin of the 2d segment a little less strongly upturned; the border of

the first segment preceded by a little stronger zone of punctures and its suture a little more salient. Border of segments 2-4 sinuate in the middle.

Insect black, clothed with yellowish hair. Mandibles and clypeus yellow; this last very finely bordered with black and often offering on the summit a vertical black line. A line behind the eyes, a spot on the front, and a little vertical line on their inner border beneath the ocular sinus; these are black. Anterior border of the prothorax widely yellow; the yellow often encroaching upon the surface and extending along its hinder borders. Tegulae, a spot beneath the wing, post-scutel, two spots on the scutel, yellow. Abdomen wholly yellow; the anterior face of the first segment black, as well as a depression at the base of the second and often a widened mark behind, on the first. Legs yellow, coxae and femora black. Antennae orange; the scape before yellow and the last third black, or obscure above. Wings ferruginous, with the end gray. The markings are of a sulphur-yellow.

Var. Scape of the antennae yellow with a black line above.

♂. Smaller. Clypeus yellow, bidentate. Antennae large, terminated by a small hook. Angles of prothorax *very salient*; border of 2d segment very rugose, more strongly reflexed; 1st and 2d segment with a great black square notch (variable), the following segments black, bordered with yellow. Anus black.

Res. a. diff.—This *Odynerus* may be almost considered as a California variety of the *O. tuberculiceps*, in which the red markings have passed into yellow, all becoming reduced; the metathorax being black, etc. This insect presents, like the *O. sulfureus* and like the Californian *Polistes*, a striking example of the local influence of California which tends to give to insects a uniform sulphur-yellow color by the augmentation in extent of the yellow ornaments and the reduction of the deeper color.

Hab. California. I owe twenty individuals to the kindness of Mr. Sutter and of Mr. Berton.

28. A. pilosus SAUSS.—Niger, longe nigro-pilosus, hirsutus; pronoto angulato, metanoto utrinque tenuissime bidentato; primi abdominis segmenti sutura in facie antica sita; 2ⁱ segmenti margine valde punctato; puncto frontali, pronoti margine, fascia interrupta in scutello et in post-

scutello, tegulis, abdominisque segmentorum 1ⁱ, 2ⁱ margine, albidis; alis vix infumatis.—♂. Clypeo albido truncato.

Odynerus pilosus SAUSS. Et. Vespidae, III, 218, 111 (1854).

Hab. Peru. (Type in the museum of Paris.)

- c. *Abdomen not as sessile; its first segment narrowed, distinctly narrower than the second, which is in the shape of a hawk's bell, with a reflexed margin. Metathorax not excavated in the form of a wide cavity, but of a wide channel.*

29. A. Aristæ SAUSS.—Medius, niger, argenteo-sericeus; puncto frontali et post-oculari flavo; thorace punctato; pronoto valde biangulato, in medio flavo-notato; metanoto convexo, in medio canaliculato-diviso; abdomine laud sessili, primo segmento late infundibuliformi sutura angulata, secundo ventricoso, margine maxime canaliculato, rugoso et reflexo; segmentis omnibus flavo-marginatis; alis ferrugineis.—♂. Clypeo flavo, bidentato; antennis subtus ferrugineis, scapo flavo-fasciato.

Odynerus Aristæ SAUSS. Revue Zool., IX, 1857, 274.

♂. Total length, 12 mm.; wing, 10 mm.

Size moderate. Form wide, stubbed. Prothorax armed on each side with a strong tooth, its anterior border wide and turned up. Post-scutel blunt. Metathorax forming two convexities, swelled, separated by a profound striate furrow, which is divided by a vertical carina; the convexities bordered exteriorly by the lateral edge of the metathorax which is prolonged as far as its inferior extremity. Abdomen quite misshaped; the first segment widely bell-shaped, the suture very distinct, not being straight, but forming in the middle an angle directed backward; its superior face short and wide, the posterior border formed by a cordon, along which is a line of punctures. Second segment widened and a little retracted posteriorly in the form of a hawk's bell; its posterior border *very strongly canaliculate, very strongly upturned*, undulating in the middle. Head densely, thorax more strongly but less densely punctured. First segment of the abdomen slightly punctured near its border; the second segment very much so toward its hinder part, and cribose with rugose punctures in its strong flutings; the following segments having the borders punctured, especially in the middle.

Insect black; all its body covered with a beautiful silvery velvet pile, above all on the abdomen which has beautiful reflec-

tions. A spot on the front, one behind the eye, a little line in the middle of the prothorax, yellow. Tegulae black, bordered with brown. All the segments of the abdomen regularly margined with yellow; the first carrying but one narrow yellow band; the second widely bordered. Legs black, knees, tibiae, and tarsi varied with ferruginous. Wings washed with yellowish, with the end grayish.

♂. Clypeus yellow, wider than long, notched in a half circle and strongly bidentate; its teeth quite removed. Labrum and mandibles yellow. Antennae black, terminated by a little hook, ferruginous beneath, with a yellow line on the scape.

Rees. a. diff.—A species very distinct by its form, by the angular suture of the first segment and by the very deep flutings of the second; by its slightly sessile abdomen and its watery reflections. By its velvety reflections, this species recalls the *O. Parredesi*, but its forms are entirely different.

Hab. The temperate regions of Mexico. I took two males about Yautepec in the south of the province of Mexico.

Division STENANCISTROCERUS.

SAUSSURE *Vespides*, I, Sect. 1, c, p. 140; III, Sec. 2, p. 129.

Form lengthened; body slender and cylindrical, rather than depressed. Prothorax little retracted or none, angulate; abdomen cylindrical or campanulate, often little sessile. First segment bell-shaped, rounded before, or cupuliform, or in the form of a truncate or subpediculate bell; often lengthened, its two faces frequently not being distinctly separated, but passing from one to the other convexly; the suture variable, often irregular, either a little salient or followed by a transverse fluting, often placed on the anterior face. The whole insect strongly punctured; the abdomen in most cases coarsely punctured.

The insects of this division are remarkable by their elongation, and by their cylindrical or compressed form. The clypeus is generally narrower than in the *Ancistrocerus*, properly speaking. The thorax is arched above, cribose with great punctures, and the grooves of the mesothorax, in general, wholly wanting. The tegulae are large and closely fitted, containing the arch of the back, and behind these one sees an apophyse or

appendix, and on each side of the scutel is a distinct depression. While in the true *Ancistrocerus* the post-scutel is nearly always truncate posteriorly, having a posterior face (with rare exceptions),¹ in *Stenodynerus* it is not truncate but angulate posteriorly; the metathorax being produced a little beyond the post-scutel and not so sharply truncate posteriorly, from which circumstance the posterior angle of the post-scutel is not cut off. The posterior plate of the metathorax never offers a basin regularly bordered as in the true *Ancistrocerus*, and with spiniform angles. The abdomen is in general strongly punctured;² the first segment being also as much or more strongly punctured than those following. This segment is sometimes convex, rounded, at times divided into two distinct faces by the suture as with the true *Odynerus*; but the superior face is often narrow and lengthened, not short and wide as in the true *Ancistrocerus*.

The suture is often placed at once on the declivity of the anterior face of the first segment. It is subject to become indistinct, so that one does not know whether to consider it as a suture or a simple line of rugosities. Among certain species one perceives a double rugose line and between the two lines a sort of fluting, so that the segment appears to have two sutural lines.

The *Stenancistrocerus* have an appearance, which, when it is known, permits one to distinguish them quite easily from the true *Ancistrocerus*, the form being wider and more flattened. But they resemble in so striking a manner certain *Stenodynerus*, that one can confound them with these last, and there are very many species of each group with forms so *correspondent*, that without the presence or the absence of the suture at the base of the abdomen, one would confound them specifically. (See the *Odynerus* of the Division *Stenodynerus*.)

In fine, I will indicate as an empirical guide, what may serve to distinguish the *Ancistrocerus*, properly called, from the *Stenancistrocerus*; in the first the band on the 1st abdominal segment is in general either regular or widened on the sides, while in the second it is either regular or retracted on the sides.

¹ *Ancistrocerus cingulatus* Cress.

² The species of South America, particularly those of Chili, often have the abdomen feebly punctured.

Table to assist in the determination of the species of Division
*STENANCISTROKERUS.*¹

1. Wings fuscous.
 2. Body black, ornaments luteous or yellow.
 3. No separate spots on the second segment.
 30. { *Aztecus*.
 31. { *quadrisectus*.
 - 3, 3. Two separate spots on the second segment.
 39. *dejectus*.
 - 2, 2. Body black and rufous.
 36. *histrio*.
- 1, 1. Wings smoky or subhyaline.
 2. The first abdominal segment rufous.
 36. *histrio*.
 3. Insect black and yellow (the fasciæ sometimes rufous).
 4. Second abdominal segment with a yellow spot on each side.
 5. Segments 1st and 2d only, margined with yellow.
 6. Scutel yellow; first abdominal segment without separate yellow spots, narrow.
 33. *obliquus*.
 - 6, 6. Scutel black; segments 1 and 2 with yellow spots, about equally wide.
 38. { *arcularis*.
 39. { *dejectus*.
 - 5, 5. More than two segments margined with yellow.
 - Segments 1, 2, 4, margined with yellow.
 42. *occidentalis*.
 - Segments 1, 2, 5, margined with yellow.
 39. *dejectus*.
 - Segments 1-5 margined with yellow.
 43. *Paraensis*.
 - 4, 4. Second abdominal segment without yellow spots.
 5. First abdominal segment with a lateral spot on fascia anteriorly.
 37. { *fulvipes*.
 40. { *Bravo*.
 - 5, 5. First abdominal segment without lateral separate spot.
 6. Only the first two abdominal segments margined with yellow or luteous.
 7. Anterior margin only of prothorax adorned with yellow.
 - Species of South America.
 34. *incommodus*.
 - Species of Mexico.
 40. *Bravo*.
 - Species of Chili.
 35. { *ambiguus*.²
 35. { *scabriusculus*.
 - 7, 7. Posterior margin of prothorax adorned with yellow.
 32. *Furiosi*.
 - 6, 6. More than two yellow fasciæ.
 7. Anterior margin of prothorax yellow.
 41. *Guzmani*.
 - 7, 7. Posterior margin of prothorax yellow, or prothorax quite black.
 44. *Sumichrasti*.

¹ Compare also the tables of Division *Ancistrocerus*, prop. dict. (page 158), and of Division *Stenodynerus*.

² Vide supra, Division *Ancistrocerus*, prop. dict. p. 159, 9, et 162, 9.

1. *Form lengthened. Metathorax prolonged horizontally behind the post-scutel, then truncate vertically; offering above, in the rear of the post-scutel, a sort of cavity limited posteriorly by a vertical plate divided by a fissure. First abdominal segment entirely sessile, wide, distinctly truncate anteriorly, so as to form a sharp transverse ridge, its suture indistinct, especially in the middle. Vertex of the females offering two little mammæ filled with hair. Males nearly as large as the females.*¹

(Group of the *O. quadrisectus*.)

(SAUSS. Vespides, I, p. 145, Sect. 24.—Division *Pseudodynerus*.
Ibid. III, 220.)

30. A. Aztecus SAUSS.—Gracilis, niger, nitidus, grosse foraminato-punctatus; vertice arcubus duobus penicillatis instructo; metanoto pone post-scutellum producto, postice foveolato, superne cristulam per fissuram divisam ferente; abdomine dense punctato; antennis subtus ferrugineis, scapo flavo-lineato; mandibulis, tibiis anticis, puncto frontali; clypeo ♀ lineolis 4, ♂ omnino, pronoti et abd. segmentorum 1, 2 margine, post-scutello, macula subalari, metanoti punctis 6, et primi segmenti puncto utrinque, luteis; alis infuscatis violaceis.

Odynerus Aztecus SAUSS. Revue de Zool., 1857, 275.

Total length, 15 mm.; wing, 15 mm.

♀. A species closely allied to the *O. 4-sectus*, having the same form, but smaller. Clypeus pyriform, very coarsely punctured, with a depressed point, and carrying toward the apex a vertical groove. Head and thorax polished, cribose with great holes. On the vertex, behind the ocelli, one sees two tubercles of brown hair; or a double bush of hair surrounding a smooth space. Anterior border of the prothorax slightly concave; its angles sharp. Metathorax not retracted behind; its superior face cribose with strong punctures like the remainder of the thorax. Its concavity smooth, excavated, finely punctured, with blunted borders, except at its superior extremity, where it is terminated by a little vertical plate. Abdomen quite slender; its first seg-

¹ In the third volume of my *Etudes sur la Fam. de Vespides*, p. 220, I have placed in this Division the *O. luctuosus*, but it would be better placed in the Subgenus *Odynerus*. (See below the corresponding Section formed by this species.)

ment cribose with punctures of a little less size than those of the thorax, its suture distinct; near to its border, a badly marked depression. The remainder of the abdomen less strongly and densely punctured; the punctures throwing forth some short, gray hairs.

Insect black. Antennæ ferruginous above. Mandibles before, borders of the summit of the clypeus, two little lines toward its base, a dot on the forehead, scape of the antennæ before, border of the prothorax, a large spot beneath the wing, a dot on the wing scale and its posterior appendix and post-scutel, of a pale yellow. One sees in addition, six yellow spots on the metathorax, two at the sides of the post-scutel, two on the angles of its posterior plate, and two lines at the top of its concavity. Segments 1, 2, ornamented with a border of the same color, narrow, submarginal, and at times interrupted on the 2d segment; the first adorned in addition with two lateral dots which at times join themselves to the border. Legs black, tarsi brownish, anterior tibiæ yellow before. Wings of a transparent brown with beautiful violet reflections.

♂. Clypeus bidentate, yellow, with a very fine black edging all around it. Vertex with no hairy tubercles. A pale yellow spot on the front. Hook of the antennæ brownish.

Var. The yellow markings more or less extended; the bordering of the prothorax interrupted, and the concavity of the metathorax bordered with whitish.

Hab. The coast of Mexico. I caught ♀ ♂ near Tampico.

31. *A. quadrisectus* SAY.—Validus, gracilis, grosse foraminatopunctatus; clypeo apice truncato; corpore albido-variegato; maculis 2 magnis pronoti, macula subalari, post-scutello, maculis 2 magnis metanoti, abdominisque segmentorum, 1^a, 2^a limbo, albidis; primo superne albido, macula nigra; alis nigro-violaceis.

Odynerus quadrisectus SAY, Bost. Journ. I, 1837, 385, 1.—SAUSS. Et. Vespides, III, 206.¹—SAY's Entom. (LE CONTE), II, 765, 1.

Odynerus Bellone LEPHEL St. Farg. Hymen. II, 660, 40 (1841).—SAUSS. Et. Vespides, I, 146, 32, pl. xvi, fig. 10, ♀.

Total length, 20 mm.; wing, 16 mm.

¹ The variety fig. 1. c. pl. ix, fig. 9, ♀, is quite a different species. Comp. *Monobia maxillaris*.

♀. Of a shining black, closely allied to the form of the *O. Aztecus*, but larger, and with the whitish markings more developed. Upon the vertex two tubercles of brown hair. Body equally cribose with great punctures, but the metathorax insensibly retracted behind; and its vertical plate a little more elevated. The second segment a little more swelled above, so as to imitate a sort of indistinct tubercle. Mandibles often spotted with yellow at their base. Clypeus black, ornamented toward the top with two lateral yellow lines, its inferior extremity truncate and cut out into a furrow rather than a groove. A line on the scape of the antennæ, a spot on the forehead, two great triangular spots on the prothorax, a spot beneath the wing, two dots on the wing scales, post-scutel, two great slashed spots on the metathorax and the border of the first two segments of the abdomen, whitish. The first segment yellow above, with a triangular black spot or having at least two lateral spots reunited with the bordering. Wings brown with violet reflections.

♂. Clypeus of the same form with that of the female, offering at the summit a white arc and below two white lengthened spots (or almost entirely white); this color terminates toward the bottom in four teeth and often presents in the middle a black dot. Hook of the antennæ ferruginous. No little hairy mammæ on the vertex.

Var. a. Two yellow spots on the scutellum.

b. Post-scutel black. Two yellow spots on the prothorax and two on the metathorax; only two yellow spots on the border of the second segment of the abdomen (Sauss. *Vespides*, III, pl. ix, fig. 9). This last variety may be noted as like that of *St. Marte* in Columbia, in South America. It may very well be a distinct species from the *O. 4-sectus*.

Hab. The United States, especially at the South. I possess specimens taken in Louisiana, Florida, Carolina, Tennessee, Pennsylvania.

Res. a. diff.—This species differs from the *O. Aztecus*, by the entire border of the clypeus, by its black antennæ and feet, by its greater size, and by its always more extended ornaments. These are in general whitish, at times of a pale golden. It bears a great resemblance at times to the *O. luctuosus*.

2. *Form very slender. Metathorax not so distinctly produced behind the post-scutel; its concavity large, limits rather well defined. First abdominal segment elongate, bell-shaped, having a distinct suture.*

(Group of *O. histrio*.)

- A. *First segment of the abdomen rather funnel-shaped or bell-shaped, truncate anteriorly.*

32. A. Fariasi SAUSS.—*Sat minutus, gracilis, foraminato-punctatus; pronoto bidentato, metathoracis foveola grosse punctata, angulata; abdominis primo segmento infundibuliformi, basi truncato, secundo angustiore; antennis et tarsi subtus ferrugineis; pronoti marginibus tenuissime albido-limbatis, post-scutelli limbo antico, macula subalari, lineolis 2 in metanoti canthis abdominisque vittis 2, albidis.*—♂. Clypeo albido, elongato, bidentato.

Odynerus Farias SAUSS. *Rev. de Zool.*, 1857, IX, 274.

♀ ♂. Total length, 11 mm.; wing, 8 mm.

♀. Slender, lengthened. Head densely cribose with great punctures. Clypeus bearing some great shallow punctures, strongly bicarinate toward the bottom. An impressed point on the vertex. Thorax smooth, cribose, with holes slightly separated; metathorax rugose above. Prothorax scarcely retracted before; its anterior border concave; its angles spiniform. Metathorax retracted and slightly prolonged behind the post-scutel, then truncate; its posterior plate forming rather a truncation than a concavity; this plate a little triangular; widened at the summit, retracted below, its form sharply defined, although with little or no border; having its latero-inferior borders armed with a trenchant edge directed backward, and which terminates inferiorly in two strong teeth between which fits the base of the abdomen; the contour of the cavity angulate, forming on each side a sharp angle, but which is not detached in the form of a tooth; the summit of the plate cribose with great punctures, but the lower portion is excavated into a striate furrow, punctured, and divided by a vertical carina. The whole plate defined in a manner comparable to a double pentagon, characteristic of the *Ancistrocerus*, properly called (comp. p. 157, ex. *O. capra*), but here the pentagon is lengthened, higher than wide. Abdomen lengthened, the first segment prolonged, bell-shaped,

but truncate before, narrower than the 2d segment; its superior face lengthened trapezoidal, offering at times a trace of a longitudinal groove; the suture distinct, placed on the anterior fourth of the segment, but clearly separating the anterior and superior faces. Second segment prolonged, slightly retracted at its base; its surface cribose with great, slightly separated, punctures, more crowded toward the posterior extremity; the following segments finely punctured. Border of the 2d segment not channelled.

Insect black, with some gray reflections. Antennæ ferruginous beneath. A dot on the front, an edging ornamenting the anterior and the posterior border of the prothorax, a line on each side on the ridges of the metathorax, the anterior border of the post-scutel and a spot beneath the wing, whitish, or pale-fawn color. Posterior border of abdominal segments 1 and 2 ornamented by a whitish cordon; that of the 2d segment very slender. Knees and tarsi slightly ferruginous. Wings hyaline or washed with brown. Tegulæ bordered with ferruginous; their appendix very wide, squamiform, yellow.

Var. Two spots or yellow lines on the summit of the clypeus.

♂. Abdomen more rugose, also more of venter; the 2d segment more swelled, and more compressed at its base; no little excavation on the vertex. Clypeus prolonged, terminated by two blunt teeth, whitish; the carina of the front, the scape beneath, and a line bordering the orbit as far as the bottom of the sinus, whitish. Antennæ fawn-colored beneath, with the last articles black; the hook black, lengthened and arcuate.

Res. a. diff.—This species is very remarkable in the structure of its metathorax. It approaches in its form to *Symmorphus*, the first segment being narrower than the second and campanulate, and the metathorax being truncate as in the *Symmorphus*; but it belongs distinctly to the subgenus *Ancistrocerus*, as is evident from the absence of the distinct dividing groove of the first abdominal segment, the cylindrical form of the thorax, the prothorax not retracted, the kind of punctures, the pyriform clypeus, and the presence of a large hook on the antennæ of the male; the mesothorax offers no more longitudinal grooves; the post-scutel is not rugose, nor the 2d segment smooth as with the *Symmorphus*. It has quite the form of the *O. incommodus*, but

is distinct from it in not having the border of the 2d segment at all turned up.

Hab The Mexican coast. Tampico and the barrancás of the Cordillera. 15 ♀, 12 ♂.

33. *A. obliquus* CRESS.—Niger, nitidus, sulfureo-multipictus; antennis basi flavis; pronoti angulis in dentem productis; metanoto postice planato; abdominis segmentis 1^o 2^o late flavo-marginatis; 2^o basi flavo-bimaculato; 1^o valde punctato, valde angustiore quam secundum; sutura distincta; alis rugulosis, costa et stigmate ferruginescentibus; macula radiali fusca.

Odynerus obliquus CRESS. Philad. Ent. Proc., IV, 1865, 163.

Total length, 8.5 mm.; wing, 6.5 mm.

♂. Small, punctate, very shining. Head circular. Thorax rather attenuated behind; prothorax square, polished; its angles rather dentiform; scutels flattened, polished; metathorax polished, but slightly punctate, flattened behind, destitute of lateral angles, with the lateral carinæ not very sharp. Abdomen slender; the first segment small, half as wide as the second, rather elongate-bell-shaped, punctate like the thorax; bearing an obsolete depression; its suture very distinct. Second segment ovate, as long as wide, with effaced or delicate punctures, subtuberculate above.

Black. Antennæ fulvous beneath; the first two joints yellow, mandibles yellow; the forehead between the antennæ, sinus of the eye, and a broad margin behind them, sulphur-yellow; a broad anterior margin on the prothorax; the large tegulæ, a large spot beneath the wing, scutel, post-scutel, angles of metathorax, a broad marginal fascia on the border of the first two abdominal segments, and a spot on each side at the base of the second segment, sulphur-yellow. Feet yellow; coxæ black, the 1st and 2d pair yellow anteriorly; posterior coxæ and femora black. Wings subhyaline, cloudy, principally at the extremity, with a dark cloud in the radial cell; the anterior costa and the stigma rather ferruginous; sometimes the wing is ferruginous with its apex smoky.

♀. Clypeus pyriform, punctate, bidentate, yellow, with its apex black.—♂. Clypeus yellow, rounded-pentagonal, terminated by two little triangular teeth, separated by a triangular notch. The yellow margin of the second segment is wide and regular; that of the first not so wide and rather narrowed on the sides.

Res. a. diff.—In its size and colors, this has rather the appearance of *O. cingulatus*, but is very distinct from it in its more slender body; its metathorax, without bordered cavity; its narrow first abdominal segment, with the yellow margin narrowed, not widened at the sides, and in the two yellow spots of the 2d segment. These spots and the partly ferruginously tinged wings distinguish it from all the other *Stenancistrocerus*.

Hab. Cuba (Dr. Gundlach).

34. *A. incommodus* SAUSS.

Odynerus incommodus SAUSS. *Vespides*, I, 143, 29, ♂, 1852.

O. tolteco affinis species at diversa.

Hab. America meridionalis. Columbia (Typus in mus. Parisiensi).

B. First segment of the abdomen in form of a prolonged bell, rather squarely-rounded, about as wide as the second segment, not contracted before.

a. First segment sharply truncate anteriorly.

35. *A. scabriusculus* SPIN.—Parvulus, niger, gracillimus, elongatus, cylindricus, valde punctatus; clypeo ♀ convexo, punctato, apice truncato; thorace elongato, antice lato, bidentato; postice angustiore; ubique grosse punctato; metanoti rugosi foveola punctata marginibus rugosis, superne canthis prominulis acutis marginata; his a post-scutello per fissuram sejunctis; abdomine gracillimo, cylindrico; primo segmento basi distincte truncato, supra grosse punctato; secundo elongato, dense punctato; haud latiore quam primum, margine haud rugoso; antennis subtus ferrugineis; puncto frontali et oculari, pronoti marginis antici fascia sinuata, macula subalari, tegulis, post-scutello, abdominisque segmentorum 1ⁱ, 2ⁱ limbo albidis; tibiis extus albidis. Alis hyalinis. Longit. 7.5 mm.

♂. Clypeo emarginato, albido; fascia in scapo et orbitarum margine interno, albidis.

Odynerus scabriusculus SPINOLA, in Gay's *Hist. fisica de Chile*. Zool., VI, 232.—SAUSS. *Vespides*, I, 140,¹ 24; III, pl. xi, fig. 1,¹ ♂.

Hab. Chili.

This *Odynerus* is remarkable by its very slender form and by its first abdominal segment being sharply truncate, in such a

¹ Page 141, in place of: *ferrugineux*, read *fortement ponctué*.

manner that there exists one anterior and one superior face, distinctly separated by a trenchant ridge which bears the indistinct suture. This segment is not campanulate, but almost as wide before as on its posterior border.¹ The 2d segment is hardly wider than the first.

- b. First abdominal segment more rounded anteriorly, rather like a square bell. (Metathorax slightly prolonged behind the post-scutel; then truncate; its concavity rounded. Body rugose.)*

36. A. histrio LEP.—*Gracillimus, rugosissime punctatus; metanoto rugosissimo profunde foveolato, foveolæ canthis valde prominentibus et acutis; niger, antennis, macula frontali et oculari, pronoto antice, tegulis, macula subalari, post-scutello, metanoto utrinque, abdominis primo segmento pedibusque rufis; alis cyanescentibus.*

Variat. Post-scutello et abdominis segmentorum 1¹, vel 1¹, 2¹ margine, amantiacis.

Odynerus histrio LEP. St. Farg. Hyménopt. II, 638, 23² (1841).—SAUSS. Vespides, I, 208, 112; III, 242.

† *Odynerus ammonia* SAUSS. Vespides, I, 144, 30 (1852).

Total length, 11 mm.; wing, 9 mm.

♀. Form very slender and lengthened. Clypeus pyriform, rugose, terminated by a little biangulate border, appearing bidentate, because of a terminal fossette. Head densely and strongly punctate; thorax coarsely cribose, with very large depressed points; the punctures a little separated; prothorax slightly retracted before, subangulate; metathorax retracted, rounded, but its hinder plate very strongly excavated, offering a fossette, punctured, rugose, bordered all around by very salient and trenchant ridges, of which the summit is notched and sometimes separated from the post-scutel by two grooves. First abdominal segment lengthened, a little narrower than the 2d; its superior face very rugose, as strongly cribose as the thorax, but more densely; covered like the metathorax with enormous reticulate rugosities, and offering a vague depression on its anterior part; its irregular suture, placed but a little on the anterior face and often followed by a fluting. Second segment prolonged and slender, strongly punctured; its border very coarsely punctured.

¹ In the fig. cited, this segment is badly represented; it has not this rounded form.

² Page 639, in place of 3 lines, read 5 lines.

Insect black. Mandibles, summit of the clypeus, the first two or three articles of the antennæ, a spot on the forehead, the inner border of the orbits, or a spot in their sinus, a spot behind the summit of the eye; two spots on the prothorax, tegulæ, a spot under the wings, post-scutel, angles of the metathorax, first segment of the abdomen, and feet, red; bordering of the first two segments of the abdomen, yellow. Wings brownish, with violet reflections.

Var. a. Clypeus wholly red.

b. Second segment entirely black; only presenting an interrupted border.

c. The ridges which border the fossette of the metathorax blunt, interrupted on the summit. The suture of the first segment effaced by the punctures. Punctures notably less coarse. (In general, some small females with the 2d segment bordered with yellow.) Wings only smoky toward the end.

♂. Sculpture very coarse. Clypeus punctate, shortly bidentate, pale yellow or orange. Scape of the antennæ often adorned with an orange line; the flagellum like that of the female, or wholly black, or ferruginous beneath in its first moiety; hook black. Size as with the female.

Var. A. Post-scutel yellow. The ornaments of the head and those of the anterior part of the corselet, orange or yellow. Their size variable.

B. Metathorax entirely red.

C. No yellow band on the first segment; its base black.

D. The prothorax almost entirely red.

E. Second segment adorned with two yellow dots. (The *O. ammonia*.)

Res. a. diff.—This species is distinct by the coarseness of the punctures, by the strength of the ridges of the metathorax, and by the red ornaments of the body.

Hab. The Southern United States. Carolina. Florida, etc. 5 ♀, 4 ♂ (E. Norton).

Observation.—We have not before our eyes a specimen which corresponds to our description of the *O. ammonia* Sauss., in which the 2d abdominal segment is ornamented with two yellow spots and the suture of the first very indistinct or wanting. We think, however, that this *Odynerus* is but a variety of the *O. histrio*.

37. A. fulvipes SACSS.—Niger, elongatus, cylindricus, crassissime punctatus, flavo vel rufo multipictus, frequenter ♀ macula mesonoti flava; abdominis segmentis valde punctatis 1♂, 2♂, limbo flavo; primo insuper utrinque fascia flava, et sutura elevata distincta; secundi margine paulum canaliculato, paulum reflexo.

Odynerus flavipes SACSS. Vespides I, 142, 27 (Syn. excl.); pl. xvi, fig. 3, ♀, 1852; III, 205.

Odynerus fulvipes SACSS. Vespides, III, 205 (1854).

Total length, 12 mm.; wing, 9 mm.

♀. Form very slender, lengthened, cylindrical. Clypeus pyriform, slightly truncate at the extremity, very coarsely cribose, especially toward the bottom. Head coarsely punctured. Thorax quite cylindrical, arched, very coarsely cribose. Prothorax finely rimmed; its angles a little dentiform, directed forward. Metathorax slightly prolonged behind the post-scutel; its hinder plate strongly concave in all its width, strongly punctured; its borders a little trenchant or blunted by the very large reticulate holes which occupy the superior face of the metathorax, forming sometimes at the summit two ridges separated from the post-scutel by a fissure. Abdomen cylindrical, the first segment bell-shaped, lengthened, as wide as the second; its suture distinct, but placed upon the declivity of the anterior face, and often followed by a groove; 2d segment cylindrical, not swelled, nor wider than the 1st. The first two segments strongly punctured throughout the length of their posterior border, the border of the 2d lightly reflexed. The 2d segment offers some very large sparse points beneath. The 3d segment is cribose with immense depressions, especially in the middle.

Insect black; a spot on the mandibles, an arc on the summit of the clypeus, a line on the scape of the antennæ, a spot on the forehead, one in the sinus of the eyes, one behind each eye, an interrupted border on the prothorax, a spot under the wing, another at the base of the disk of the mesothorax before the scutel, post-scutel, angles of the metathorax, regular border on the 1st and 2d segments of the abdomen, and two oblique lines on the sides of the first, orange. Tegulæ red, spotted with yellow; their appendix yellow. Legs black, knees, tibiæ, and tarsi orange. Wings transparent, smoky, a little violet toward the end.

Var. a. No yellow spot before the scutel.

b. Clypeus, metathorax, and femora black.

c. The markings pale yellow; no spot before the scutellum.

d. Some individuals from Florida have all their markings orange or blood red. The wings are a little more smoky. These specimens are also more strongly cribrate, more rugose; the first moiety of the antennæ is reddish with a black line on the scape. One sees on the first segment a transverse fluting which passes along the suture, especially distinct upon the sides, at times effaced in the middle. As one finds all the transitions of our type in these individuals, I have concluded that it is but a simple variety, formed by a more perfect development of individuals under the influence of the heat of the climate of the southern districts. These individuals have no mesothoracic spot before the scutellum.

♂. Almost as large as the female. Clypeus prolonged, polygonal, bidentate, yellow or whitish; its teeth slightly variable, at times black; inner border of the orbits yellow; spots of the metathorax small or wanting. Second segment of the abdomen a little wider.

Res. a. diff.—This species is difficult to distinguish from the *O. sæcularis* and the *O. pedestris*. (See the description of these species.) In other things it closely approaches the *O. vagus*, *O. conformis*, which have almost the same marking, but do not offer any suture on the 1st abdominal segment; a little less similar also to the *O. collega* and *Xantianus*, which have, however, the 2d segment more swelled and which finally offer no suture on the first abdominal segment.

One often sees the suture in this variety become feeble, seeming then to form a transition to the *O. vagus*; nevertheless, the metathorax is always more rugose than in this species, and the punctures of its thorax are stronger also.

Hab. The Southern United States, Louisiana, Florida, Tennessee, Illinois. 5 ♀, 6 ♂.

38. A. sæcularis SAUSS.—Niger, elongatus, gracilis, cylindricus, grosse punctatus; flavo-multipictus; *O. fulvipedi* simillimus, sed metanoto rotundatiore, abdominis primo segmento grossius punctato, supra valde punctato, antice lævi, sutura vix perspicua; segmentis 1-4 flavo-limbatis, primo insuper fascia interrupta flava et secundo macula utrinque flava.

Odynerus sæcularis SAUSS. Et. Vesp., I, 142, 26.

Form, sculpture, livery, almost identical with that of the *O. fulvipes*. The size may be a little less. In fact it cannot be distinguished from this species but by the following characters.

Prothorax not having its angles dentiform. Concavity of the metathorax having its borders perhaps a little more coarsely punctured, more rounded. First abdominal segment more strongly cribose; its punctures as strong as those of the thorax. The suture feeble, but yet distinct. (The anterior face of the segment is smooth and the superior face is very coarsely cribose with little or no channel along the suture.)

The livery differs by the yellow being a little more extended on the head, a wider yellow arc on the clypeus, and the yellow of the scape much extended at the base. Segments 3-4 also are bordered with yellow and the 2d segment *ornamented on each side near its base with a yellow spot*; the two oblique spots of the first segment forming an interrupted band.

Var. Mesothorax above with or without yellow spot.

♂. The metathorax is notably more rounded than with the *O. fulvipes*, and does not form two lateral angles. Clypeus, mandibles, inner bordering of the orbits, and the legs, yellow, as well as the femora. The remaining livery as with the female; the 1st segment ornamented with an interrupted band, and the 2d with two lateral spots, yellow. No yellow spots on the disk of mesothorax.

In spite of these differences the *O. sæcularis* may be but a *var.* of the *O. fulvipes*.

Res. a. diff.—Naturally, this species has a very great resemblance also to the *O. conformis* and *vagus*, but is distinguished above all by its first abdominal segment, of which the great punctures are *suddenly* arrested on meeting the anterior face of the segment so as to define the suture. It differs from the *O. anormis* by its more cylindrical abdomen, more strongly punctured, with the 1st segment more lengthened, adorned with two oblique bands and not with two yellow dots. Compare also the *O. dejectus*.

Hab. The Southern United States. ♀ ♂ from Tennessee.

Observation.—The *O. fulvipes*, *sæcularis*, *vagus*, *conformis* are types which appear almost to pass from one to the other and of which it is difficult to trace the precise limits. One should take notice of the first two for the variations of the same species

in which the suture tends to disappear or has itself well developed. See also the *A. collega* and *Xantianus*.

39. *A. dejectus* Cresson.—Niger, clypeo valde emarginato, superne flavo; capitis maculis, antennarum scapo, pronoti margine antico, macula mesonoti et subalari, tegulis, post-scutello, metanoti canthis, abdominis segmentorum 1ⁱ, 2ⁱ, 5ⁱ, margine tibiisque, flavidis; primo abdominis segmento valde punctato, utrinque fascia obliqua flavida; 2^o utrinque macula flava; alis fusco-hyalinis. ♀.

Odynerus dejectus Cresson, Philad. Ent. Proceed. IV, 1865, 164, ♀.

Total length, 4.5 lin.

♀. Opaque black, deeply and closely punctured; a line behind the eyes near their summit, the sinus in front, a spot between the insertion of the antennæ, and the basal half of the clypeus, deeply and squarely emarginate before, obscure yellowish; antennæ black, the basal joint, except the apical half above, yellow. Thorax; the anterior margin of the prothorax slightly interrupted on the disk, a small quadrate spot on the disk of the mesothorax posteriorly, tegulæ, a minute spot on each side just behind the tegulæ, a round spot on each side of the pleura, the post-scutellum, and an elongate mark on each side of the metathorax, yellowish. Legs black; tips of the four anterior femora, their tibiæ, and the posterior tibiæ, except tips, yellowish. Abdomen robust, not much contracted at base; basal segment roughly punctured, with a faint transverse suture at base, its apical margin bordered in the middle, continued along the lateral margin, and then produced to within about one-fourth the width of the segment, yellowish; second segment large, convex, shining, finely punctured, more strongly at the tip; the apical margin above and beneath, and a rounded spot on each side near the base, as well as the apical margin of the fifth segment, not quite reaching the sides, yellow. Legs black, tips of the four anterior femora, their tibiæ, and the posterior tibiæ, except their tips, yellowish. Wings fusco-hyaline, darker along the costa, darkest in the radial cell.

Res. a. diff.—Closely allied to *A. bacuensis*, but it is distinguished by its more robust form, the spot on the disk of the mesothorax, the absence of bands on the fourth and sixth segments of the abdomen, its black scutel, etc.

It is still more closely allied to *A. sæcularis*, if not the same.

Hab. Cuba.

40. A. Bravo SACSS.—*O. fulripedi* affinis, punctatissimus, niger, fulvo-pictus; abdominis segmentis 1^o, 2^o margine grosse punctato, fulvo; primo frequenter flavo-bipunctato, sutura distincta. ♀.

Odynerus Bravo SACSS. Rev. de Zool., IX, 1857, 274.

Total length, 10 mm.; wing, 8.5 mm.

♀. The slender and lengthened form of *O. fulvipes*; size and puncturing the same. Clypeus pyriform, rugose, joined to the forehead by a vertical carina; its inferior extremity subemarginate. Angles of the prothorax acute. Concavity of the metathorax rugose, coarsely punctured; its border quite trenchant. Abdomen quite cylindrical; its first segment very great, as wide as the second; its suture distinct, at times elevated and followed by a groove. All the body cribose with deep punctures forming regular pits; abdomen almost as strongly punctured as the thorax; the border of the first two segments insensibly depressed and more strongly punctured, but neither channelled nor reflexed. The following segments finely punctured.

The insect black. Mandibles brown; antennæ ferruginous beneath with scape below yellowish. A dot on the forehead, one in the sinus of each eye, and another behind each eye, often a spot or an arc at the top of clypeus, the anterior border of the prothorax, a spot under the wing, the post-scutel, and the lateral edges of the metathorax, whitish (or changing into tawny). Segments 1, 2 of the abdomen adorned with a regular whitish border; first segment in addition on each side with a little oblique line, or a spot, of the same color; one sees also a spot on the mesothorax, before the scutellum. Legs black; tibiæ and tarsi ferruginous. Wings transparent, washed with brown, above all in the radial and along the side. Tegulae large, ferruginous or pale, as well as the apophyses placed behind them.

Var. Mesothorax, metathorax, and first segment without spots.

Res. a. diff.—This species is very near to the *O. fulvipes*. But this is a little smaller in size; and the thorax appears to me a little more densely punctured. The markings are also less abundant. However, one might consider it as a Mexican variety of the same species, a little smaller, as in general the *Odynerus* are smaller within the tropics, than in the north.

Hab. The coast of Mexico. I took 2 ♀ at Pueblo-Viejo near Tampico; 2 ♀ taken near Cordova (Sumichrast).

3. *Form slender, but the abdomen sometimes slender, sometimes ovoid, especially among the ♂. The first segment cupuliform, narrower than the 2d, having the suture indistinct, often presenting a transverse fluting bordered by two traces of sutures.*¹ *Concavity of the metathorax generally small, its borders indistinct.*

(Group of the *O. occidentalis*.)

The insects of this category offer at times two sutural lines on the first segment of the abdomen (the second usually interrupted) so that one feels the need of classing them in my Division *Subancistrocerus* (Vespides, III, 206; I, 126). But as all their affinities tend toward the group of the *O. fulvipes*, I think best to leave them in the same division. The sutures become wholly double in certain species or indistinct, so that one does not know whether or not to take them for simple rugosities and class the insects which carry them in the subgenus *Odynerus* (Division *Stenodynerus*).

a. *Suture of the first abdominal segment rather strong; excavation of the metathorax somewhat distinctly margined.*

41. A. Guzmani SAUSS.—Parvulus, niger, dense cribratus; pronoto bidentato; metanoto perrugoso, foveola orbiculari punctata, submarginata instructo; abdomine valde punctato; primo segmento bisuturato; secundi margine maxime cribrato, subcanaliculato; prothoracis segmentorumque 1^a, 2^a limbo, post-scutello, puncto frontali et frequenter subalari, flavis; pedibus fulvo-variis; tegulis maximis, flavo-marginatis.

Odynerus Guzmani SAUSS. Rev. de Zool., IX, 1857, 275, ♂.

Total length, 7 mm.; wing, 6 mm.

♂. Small. Prothorax wide; its anterior border concave, turned up, forming on each side a little tooth directed obliquely forward. Head and thorax before coarsely cribose throughout. Scutel divided by a groove. Metathorax feebly prolonged behind the post-scutel, then vertically truncate, extremely rugose; its middle occupied by a circular concavity, shining and cribose with punctures; a little rimmed, especially at the summit. First

¹ Sometimes the two sutures are feeble and difficult to distinguish. It is necessary in that case to turn the insect into the proper light to perceive them.

abdominal segment cupuliform, notably less wide than the 2d, coarsely punctured and rugose; offering two irregular sutural lines, between which is a fluting or transverse furrow, apparently interrupted in the middle. Border of this segment thick. Second segment ovoid, swelled, but longer than wide, strongly punctured above, especially toward the border, which is a little retracted and channelled.

Insect black, clothed with a short gravish pile; a spot on the front, anterior border of the prothorax, post-scutel, a little dot under the wing, and a regular border on the first two segments, tawny-yellow. Tegulæ ferruginous, bordered with yellow, or yellow with a red dot. Legs black, tarsi and tibiæ varied with ferruginous or yellow. Wings sub-transparent, radius and radial cellule brown.

♂. Clypeus yellow, punctured, terminated by a split beak (or by two little separated teeth); bordered with black laterally. Antennæ black, with a yellow line on the scape.

Res. a. diff.—This little *Odynerus* is easily recognized by its first abdominal segment fortified with two sutural lines. These sutures are but little salient and the second above all (posterior) can be known by the border of the fluting, rather than by a suture. Nevertheless I think the insect well characterized by the configuration of this segment.

Hab. The temperate parts of Mexico. Mextitlan.

I dedicate this pretty species to Don Jose Mariano Guzman, the Mexican naturalist whose amiable hospitality permitted me to explore the beautiful valley of Mextitlan.

42. A. occidentalis SAUSS.—*Parvulus, niger, punctatissimus, metanoti rugosi foveola rotundata, superne vix marginata; abdominis valde punctati secundi segmenti margine paulum canaliculato grosse punctato; puncto frontali et post-oculari, pronoti margine interrupto, macula subalari, tegulis, post-scutello, abdominisque limbo segmentorum supra 1, 2, 4, 5, 6 et subtus 2, 3, flavis.*—♂. Clypeo bidentato, antennarum scapo antice, litura oculorum et pedibus, flavis.

Odynerus occidentalis SAUSS. *Rev. de Zool.*, IX, 1857, 274.

Total length, 6.5 mm.; wing, 5 mm.

Size very small. Head circular. Ocelli large, arranged in a regular triangle. Antennæ inserted below the middle of the head. Thorax wide before; its angles quite sharp, cut at a right angle. Scutel parted by an indistinct longitudinal groove. Concavity

of the metathorax regular, in the form of a concave, punctured scullicap; its borders wholly rounded and punctured, without any spiniform angle; the superior part slightly bordered by an arcade. The latero-superior parts of the metathorax quite swelled and prolonging themselves a little behind the post-scutellum. Abdomen wholly oval. First segment small, regularly cupuliform; the suture feeble, placed (about) on the anterior third of the segment; behind the suture an insensible fluting can be distinguished. Margin of the segment thick, followed by a little compression at the base of the second. Thorax densely cribose with great points. Metathorax very rugose. Abdomen strongly punctured; the second segment carrying along its border a zone of great punctures and rather narrowly channelled.

Insect black. A spot on the front, another behind each eye, the interrupted border of the prothorax, a spot under the wing, post-scutel, tegulæ, their apophyse annexed, and a spot on the mesothorax before the scutel, yellow. Segments 1, 2, 4, 5, 6, of the abdomen bordered with yellow above; *the third being only beneath*, the second equally bordered beneath; this last carrying in addition on each side a yellow spot near its base; segments 4-7 brown beneath, without bordering. The borders regular. Legs yellow, black at the base. Wings a little smoky, having a great brown stigma.

♂. Clypeus yellow, higher than wide, strongly punctured, polygonal, terminated by two long separating teeth. Mandibles, a long spot between the antennæ, the inner border of the orbits as far as the bottom of the sinus of the eyes, yellow; antennæ large and long, black, with the scape before yellow, the hook black; the haunches before, yellow. Extremity of the abdomen brown, a little ferruginous beneath.

Var. Tegulæ red. No spot on the disk of the mesothorax.

Res. a. diff.—This little species is remarkable in the singular distribution of the borderings of the abdomen.

Hab. Western Mexico. Sonora, Michoacan (3 ♂).

43. *A. Paraensis* SAUSS.

O. Paraensis SAUSS. Vespides, III, 207, 95 (1854).¹

Hab. Para (typus in Mus. Parisiensis).

¹ In the description, p. 203, line 5th, instead of: *huitième cubitale*, read: *troisième cubitale*.

b. Suture of the first abdominal segment not so strong. Excavation of metathorax having its edges rounded, without precise limits.

44. A. Sumichrasti SAUSS. ♀.—*Gracilis, niger, grosse foraminato-cribratus; at metanoto parum punctato, haud rugoso, foveola parvula rotundata, haud marginata, post-scutellum attingente, instructo; abdomine valde punctato; primo segmento utrinque ad suturam parum perspicuam subcanaliculato; antennarum scapo subtus et pedibus partim, ferrugineis; puncto mandibularum, frontis, summi clypei et post-oculari, fulvis; post-scutelli fascia flava; abdominis segmentis omnibus late flavo-marginatis.* ♀.

Odynerus Sumichrasti SAUSS. Rev. de Zool., IX, 1857, 275.

Total length, 9 mm.; wing, 7 mm.

♀. A species very near to the *O. huastecus*. Clypeus a little wider than long, bearing toward the bottom two salient carinae which appear like two teeth, between which is a little slightly arcuate border. Thorax lengthened. Angles of prothorax distinct. Metathorax offering very trenchant lateral ridges; its concavity small, rounded, punctate, and striate, without defined borders, but extending as far as the post-scutel. Head and thorax very densely, strongly, and regularly punctured; the metathorax being notably less strongly so; the same offering a smooth space on each side of the post-scutel. Abdomen quite lengthened, the first segment cupuliform, almost bell-shaped, quite large, although smaller than the 2d, nearly as grossly punctured as the thorax, but smooth at its base, and offering an irregular, hardly sensible suture (especially visible when one regards the insect from before), which is not formed by a crest, but which is rather the result of the coarseness of the sculpture. Behind this suture the segment is creased on each side by a groove which makes a portion of the sculpture and of which the posterior border figures as a second interrupted suture. Second segment a little swelled above at its base, strongly punctured, above all toward its posterior border, which is not channelled but bordered by a light cordon. The following segments more finely punctured.

Insect black, covered with a gray pile, especially on the metathorax; a spot at the top of the mandibles, a dot at the summit of clypeus, another on the front, another in the sinus of each eye, and one behind the eyes, ferruginous; these dots often wanting

or very small. Scape of the antennæ beneath, tawny. Anterior border of the post-scutel, yellow; the rest of the thorax black, except a yellow dot on the appendix of the wing scale, and a rudiment of an edging on each side before the wing scale along the posterior border of the prothorax. All the segments of the abdomen widely and regularly bordered with yellow-golden; the first bordering more narrow, feebly notched in the middle. Legs black, tibiæ and tarsi varied with ferruginous. Wings transparent.

Var. The posterior border of the prothorax edged with yellow.

Res. a. diff.—A species very distinct by its metathorax, smooth or at least more smooth than the rest of the thorax. Very near to the little species of the group of *O. huastecus*; particularly above all by its thorax to the *O. Peyroti*, from which it hardly differs but by its narrower thorax and by the feeble suture of the first segment. It differs from the *O. Fariasi*, by its first abdominal segment cup-shaped, not truncate-funnel-shaped, and deprived of the crest-shaped suture; by its metathorax less rugose than the rest of the corselet, by its less slender form, etc. These last characters distinguish it also from the *A. occidentalis*, *Guzmani*, and the *O. fulvipes*, which have a more pronounced suture.

Hab. The temperate lands of Mexico. One female from the hot regions of the province of Mexico, near Cuautla (Morelos) taken by my friend Mr. Sumichrast.

DIVISION HYPANCISTROCERUS.

(*Hypancistrocerus* SAUSS. Et. Vesp., III, 222.)

Head swelled. Antennæ inserted low upon the face. Superior face of metathorax produced horizontally a little beyond the post-scutel, then vertically truncate, the posterior face having a deep orbicular cavity, with very sharp margins. Suture of first segment very salient.

This type presents the extreme form of the elongate and cylindrical *Ancistrocerus*. It forms a group corresponding to *Hypalastoroides*, by its slender body and the peculiar shape of its metathorax.

45. A. advena SAUSS.—Gracilis, cylindricus, punctatus, niger, thorace antice lato, angulato, postice attenuato; metathorace paulum ultra post-scutellum producto, truncato, foveola superne semicirculariter acute marginata, margine utrinque infere angulato; 1^o segmento angustiore quam 2um, antice truncato; 2^o superne basi coarctato, subtuberculato; antennis fulvis, flagello superne nigro; capitis maculis, pronoti margine antico et postico, macula subalari et præscutellari, tegulis partim, metanoti abdominisque segmentorum marginibus anguste, flavis; primi segmenti fascia utrinque lateraliter continuata; pedibus flavis, nigro-varii; alis infumatis. ♀. Longit. 9 mm.

Odynerus advena SAUSS. Et. Vesp. III, 222, 117; pl. xi, fig. 3, 4, ♀.

Hab.—Brasilia (Typus in Mus. Londinensi).

Division ANCISTROCEROIDES.

(*Ancistroceroides* SAUSS. Et. Vesp. III, 221; I, 146, III^e Divis.)

Second cubital cell of the anterior wing subpedunculate. (Metathorax excavated, armed on each side with a spine.)

46. A. alastoroides SAUSS.—Gracilis, niger; capite et thorace punctatis; clypeo ♂ bidentato; pronoto antice lato, quadratim secto, post-scutello bituberculato; metathorace valde excavato, acute marginato, utrinque spinoso; abdomine sericante, in basi 2ⁱ segmenti constricto; 1^o segmento superne sulco partito; clypeo, puncto mandibularum, puncto frontali et post-oculari, orbitis internis, linea scapi, pronoti margine postico, macula subalari, linea utrinque metanoti infere et fascia scutelli, flavis; antennis subtus et tegulis fuscis; abdominis segmentis 1^o–3^o flavo-limbatis; pedibus fuscis, flavo-lineatis; alis infumatis. ♂ Longit. 10 mm.

Odynerus alastoroides SAUSS. Et. Vesp. I, 147, 33, ♂.

Hab. Montevideo.

This species might almost be placed in the genus *Alastor* (subgenus *Alastoroides*), where it would form a section, characterized by the 2d cell of the wing being subpedunculate only, and by the presence of spines on the metathorax.

Subgenus **ODYNERUS**¹ LATR. (sensu strictiore).

Leionotus SAUSS. Et. Vesp. I, 151.—*Odynerus* propr. dict. SAUSS.
ibid. III, 223.

First segment of the abdomen without any transverse suture.
Antennæ of males terminated by a hook, or simple (or a little curled at the extremity, only in HYPODYNERUS).
Mandibles of the males simple.

This subgenus contains insects of the most varied forms; types stubbed or elongate, with the abdomen sessile and conical or subpetiolate with the first segment funnel-shaped.

The species with a quite sessile abdomen have been detached into the genus *Rhynchium*, and that with the most petiolate abdomen into the genus *Nortonia*.

The limits between this subgenus and the subgenus *Epipona* are not clearly defined. In subgenus *Odynerus* the abdomen is conical, ovate-conical or subpetiolate, spindle-shaped. In subgenus *Epipona* it is depressed oval, lenticular as in *Pterochilus*. In *Odynerus* the thorax is more square, its anterior margin being straight or concave, its angles often sharp, and the metathorax is generally excavated in the middle. In *Epipona*, the thorax is short, ovate; its anterior margin rather convex; the metathorax convex and rounded.

The two groups can be easily distinguished by the appearance, but not readily by the description alone. We separate the subgenus *Odynerus* into four divisions for the better arrangement of the species. Unfortunately the transitions from one form to another are so gradual, that it seems impossible to define them clearly enough. But this is the greatest difficulty in all the divisions of the genus *Odynerus*.

These four divisions are as follows:—

1. **HYPODYNERUS**.—Body depressed or stubbed. Thorax not angulate before. Abdomen rather petiolate or sessile, depressed; the first segment either quite funnel-shaped as in *Montezumia* or peculiarly cut, so that its triangular anterior face fits against the metathorax and its superior face is transverse, very short, parted by a groove; the separating ridge rounded or swelled like a transverse pad. Post-scutel not distinctly truncate.

¹ Consult. at the end of the genus, the list of the *species incertæ sedis* and of the *species dubiæ*.

Body hirsute with a long pile. Antennæ of males terminated by a long hook or spirally curled at the extremity.

These are insects of Chili or the occidental side of the South American Andes, adorned with sulphur-white and often with rufous bands, having the wings obscure or ferruginous with the extremity obscure.

2. *PACHODYNERUS*.—Body stubbed. Thorax quadrate. Abdomen quite sessile, very conical, truncate at base. Post-scutel truncate. Antennæ simple in the males, not terminated by a hook.

3. *ODYNERUS*.—Form about the same as in *Pachodynerus*; abdomen sometimes more ovate-conical, the first segment being a little contracted. Post-scutel generally truncate. Antennæ of the males terminated by a hook.

4. *STENODYNERUS*.—Form slender. Abdomen cylindrical, slender, subsessile; or spindle-shaped, attenuate at base, the first segment small, cup-shaped or funnel-shaped, not very sessile. Post-scutel entire or truncate. Antennæ of the males terminated by a hook.

The separation of these Divisions being difficult, they will be defined more fully hereafter.

DIVISION HYPODYNERUS.

(SAUS. *Vespides*, III, 225; *ibid.* I (2d division), p. 160.)

Forms of insects depressed, velvety, bristling with long hair.

Thorax little or not at all angulate. Abdomen pedicellate or sessile, with the 2d segment wide, depressed; the first variable but almost always formed according to the same system, offering a triangular anterior face which fits itself against the metathorax and a superior face, very short, divided by a groove; the meeting of these two faces forming a boss or a transverse saddle-back. Sometimes, however, the first segment is simply depressed bell-shaped. The abdomen is not conic, but oval, depressed.

These insects which represent the fauna of *Odynerus* of certain regions of South America, offer an appearance very easy to define, in view of the variety of their forms.

Above all, one can distinguish them by their velvety or long

black hair with which they are bristling, and by their exceptional livery. They have the wing for the most part strongly reddened, with the end of a brown-violet or entirely brownish; the feet red or black, often also the antennæ, tegulæ and the clypeus ♀, red; sometimes even the prothorax. Almost all carry some *yellow-white* markings, and have two bands of the same color on the abdomen. Among these insects the posterior face of the metathorax is neither more smooth nor more rugose than the rest of the thorax; it offers the same appearance, which is quite exceptional among the *Odynerus*.

Very many of these *Odynerus* have at the base of the 2d segment beneath, a fold, which seen in profile, appears like a tubercle, some specimens presenting even an acute tubercle. The clypeus of the females is pyriform, truncate, or subemarginate at the end, black or red. That of the males is *narrow, lengthened, bidentate*, and of a pale yellow color.

The form also is generally very characteristic. The posterior face of the metathorax is not shaped like that of a *true Odynerus*, but in a sort of pentagon, growing larger from its inferior extremity as far as the middle, where are the lateral angles, then finely retracted as far as the post-scutel, forming with it some latero-superior ridges which converge from below upward (the post-scutel forming the 5th side of the pentagon); here the posterior face of the metathorax is generally triangular; it widens as far as the summit and the marginal ridges, at which place they are distinct, straight, and oblique, converging toward the bottom. There remains then only the latero-inferior ridges of the metathorax. (*O. humeralis*.)

This conformation of the metathorax involves an analogous configuration in the 1st abdominal segment, for this is always such, that it in a manner conforms itself to the metathorax so that it places, or exactly fits its anterior face against the posterior face of the metathorax (and this results from the fact that the two pieces are applied against each other during the period of the metamorphosis so that they are in reality moulded against each other).

The first abdominal segment has also its anterior face triangular, and the depressed form of the abdomen causes the superior border of the triangle to be but a little arcuate.

As the metathorax is quite vertically truncate, the first segment

applies itself exactly against it, and it results that the *superior* face of this segment meets the anterior face almost at a right angle. This face is very short, sometimes four or five times wider than long (sometimes, however, it has but little width).

This structure is always the same, theoretically speaking, but it becomes less and less marked in the extreme types. So, when the first segment is petiolate and narrow, it only fits itself against the middle of the metathorax which offers then a sort of furrow to receive it, while the lateral borders of the metathorax, remaining disengaged, become rounded (*O. arcuatus*, *tuberculatus*). When the form becomes very club-shaped and the abdomen sessile, the first segment is wide, triangular, sessile (*O. Antucensis*, *villosus*), and fits itself exactly upon the whole width of the metathorax; then this is flattened or excavated in its whole width, and its lateral borders become quite trenchant. Finally, when the first segment becomes rounded and sessile and when it no longer fits itself as strongly against the metathorax, the borders of the metathorax become blunted and rounded (*O. vespiformis*) and one sees it produce a form quite similar to that of the *Vespa*.

It is easy to understand from what precedes, that the abdomen will have two forms according to the way in which one regards it.¹ If it is fitted against the abdomen it will appear sessile, for one sees only its very short superior face; if it is open it will appear more or less pediculate, for, the anterior face being triangular, it forms, when it is let down, a sort of petiole having a bell-shaped form, which would not happen if the anterior face was more or less circular.

One sees then that the petiole is only the result of a deceitful appearance of the abdomen placed in an abnormal position,² very different in this from that which the *Eumenes* offers, where the petiole exists separately and cannot be disguised by any position of the abdomen whatever. It proceeds from this fact that the lengthened types of the Division *Hypodynerus* belong truly to *Odynerus*, and not to *Eumenes*, as Spinola decided, nor to *Nortonia*, as one might be tempted to judge at first sight.

The *Hypodynerus* offers all degrees of prolongation of body

¹ Take, for example, the *O. labiatus* or the *O. humeralis* as average types.

² The normal position of the abdomen is when it is applied against the metathorax.

from the more slender types which form a passage from *Nortonia* up to the more blunted species which seem to form a transition from *Vespa* (*O. vespiformis*).

These singular Odyneri form the fauna of Chili and of the western face of the Andes. They continue, however, to overleap the chain of the Andes, to show themselves in the Argentine Republic, for the *O. albocinctus* is proved to inhabit that country on the western slope of South America.

Some analogous types extend upon the side of the Equator and of New Grenada, and appear to pause toward the direction of Venezuela. But yet these offer some altered characters, the markings become golden-yellow (*O. Romandinus*), and the forms are generally more like those of the Division *Odynerus*.

If the *Hypodynerus* form the foundation of the fauna of the Odyneri of the southern coast of the Pacific, they are not, however, the unique type of that region. One finds there, also, the *Ancistrocerus* (*O. scabriusculus*, *ambiguus*, etc.) and the true *Odynerus* (*O. Gayi*, *O. Peruensis*, etc.). But as we have indicated above, the characters of the livery which are so marked among the *Hypodynerus*, reproduce themselves more or less among all the solitary wasps of Chili,¹ although they do not continue among the hymenoptera of other families which inhabit the same countries.

In the arrangement of species, I have here followed the series created by the modification of forms, commencing with the more lengthened, and finishing with the more blunted.

I give the complete diagnosis of the species which I possess, but I must limit myself to some short diagnostic phrases for those which I have not before my eyes.

Table to assist in distinguishing the species of the Division HYPODYNERUS.

1. Wings fuscous with violet or cloudy reflections.
 2. Body and antennæ quite black; 1st abd. segment funnel-shaped.
 47. *Tapiensis*
 - 2, 2. Body ornamented with luteous bands; abdomen sessile.
 3. Antennæ and feet rufous.
 59. *villosus*.
 - 3, 3. Antennæ black, the scape rufous; feet rufous, obscure, passing into black.
 60. *obscuripennis*.
- 1, 1. Wings ferruginous, with the extremity fusco-violaceous.
 2. Prothorax rufous.
 3. Antennæ rufous, with the extremity black.

¹ Compare the former page 13, *gayella*; 50 No. 45; 162 No. 9, etc.

- 1. First abdominal segment tuberculate before its groove.
51. *tuberculatus*.
- 4, 4. First abdominal segment not tuberculate.
56. *humeralis*.
- 3, 3. Antennæ entirely rufous.
63. *ruficollis*.
- 2, 2. Prothorax black or bordered with luteous.
3. Antennæ black on the superior face.
4. Their first joint rufous.
57. *Tarabucensis*.
- 4, 4. The whole antennæ black above.
5. The 2d abd. segment tuberculate above. 49. *excipiens*.
- 5, 5. The 2d abd. segment not tuberculate above.
6. Abdomen rather petiolate; hinder margin of prothorax yellow; 2d abd. segment not tuberculate beneath.
48. *arcuatus*.
- 6, 6. Abdomen more sessile; anterior margin of prothorax yellow; 2d abd. segment tuberculate beneath.
55. *vestitus*.
- 3, 3. Antennæ rufous, or black only at the extremity.
4. Second abdominal segment tuberculate beneath, at its base.
5. Metathorax without sharp edges, not bidentate.
6. Small, post-scutel luteous; clypeus ♀ black.
52. *tuberculiventris*.
- 6, 6. Larger, post-scutel black.
7. Two luteous bands on the abdomen.¹
8. The hinder margin of the prothorax bordered with luteous; clypeus ♀ black. 65. *vespiformis*.
- 8, 8. Prothorax not margined posteriorly with luteous.
9. Abdomen rather petiolate, the 1st abd. segment much narrower than the 2d; prothorax anteriorly margined with luteous. 54. *labiatus*.
- 9, 9. Abdomen sessile; the 1st abd. segment sessile, wide; prothorax black. 64. *Maypinus*.
- 7, 7. Only one luteous band, placed on the 1st segment; this as wide as the 2d, sessile. 61. *Antucensis*.
- 5, 5. Metathorax sharp, biangulate. 62. *Chiliotus*.
- 4, 4. Second abdominal segment without distinct tubercle beneath.
5. Clypeus ♀ rufous. 53. *Molina*.
- 5, 5. Clypeus ♀ black.
6. Pronotum and segments 1, 2, margined with luteous. 50. *subpetiolatus*.
- 6, 6. Only the first segment margined with luteous. 58. *albocinctus*.

¹ Wanting in some varieties.

Description of the species.

- I. *First segment of the abdomen bell-shaped, not offering two faces separated by a ridge, but pyriform, uniformly a little comb-shaped. Appearance of MONTEZUMIA.*

These insects can also nearly figure in the genus *Nortonia*, but the concave form of the metathorax brings it rather nearer to the *Odynerus* of this Division.

47. *O. Tapiensis* SAUSS.—Omnino niger; capite et thorace punctatis velutinis, nigro-hirsutis; thorace depresso; metathorace utrinque lateraliter, superne, valde carinato, et in foveola velutino; abdomine nitido depresso, primo segmento infundibuliformi; pedibus rufis, basi nigris; alis nigro-chalybæis. ♀?—♂. Clypeo argentato, bidentato, femoribus intermediis subtus in medio dilatatis, basi excisis.

Odynerus Tapiensis SAUSS. *Revue de Zool.*, XXII, 1870, 56, 5 ♂.

Total length, 20 mm.; wing, 17 mm.

♂. *Facies of a Montezumia.* Mandibles slender and styli-form. Ocelli large, disposed in a very wide triangle. Thorax wide and strongly depressed. Prothorax widely truncate and a little turned up. Post-scutel not truncate. Metathorax having its lateral ridges very salient and trenchant toward the summit; its posterior face triangular, widening upward; the concavity quite plain, but rugose and velvety; its superior ridges not distinct. Abdomen wide and depressed; the first segment pyriform bell-shaped, depressed, subpediculate at its base and posteriorly divided by a strong groove; the 2d segment depressed, almost discoidal; offering beneath, at its base, an elevated wrinkle.

Insect of a deep black; head and thorax densely punctured and velvety; strongly pilose, woolly and bristling with long black hairs. Abdomen smooth, shining, woolly at its base. Legs ferruginous with the base black. Wings black, with violet or greenish reflections.

♂. Clypeus almost as wide as long, polygonal, clothed with silvery hair, arched in its superior moiety; its latero-inferior borders a little concave; its extremity terminated by two spiniform teeth, between which is an arcuate notch. Antennæ strong; the first article short, large, and arcuate; those following, strongly pronounced, the articulations almost nodulose above; the last article forming a large compressed and arcuate hook. Thighs of

the 2d pair slightly bent in the first third, offering beneath in the middle a dilation, lamellate, oblique, preceded by a wide notch and channelled on its anterior face.

Res. a. diff.—This little species is very distinct in its numerous characteristics. One cannot confound it with any *Hypodynerus*, in view of its uniform black color and its infundibuliform first abdominal segment, which does not offer an anterior and posterior face, separated by a transverse ridge, etc. Its appearance is that of *Montezumia* and of *Nortonia*. It is distinct from these genera by the triangular form of the metathorax which recalls the form of the thorax of *Hypodynerus*. The maxillary palpi are strongly 6-articulate, the 6th article being longer than the 5th; the labial palpi have but three large articles; the 4th is very small, almost rudimentary, which indicates a passage from *Montezumia* and from *Monobia*.

Hab. The elevated regions of the Republic of Ecuador. It was taken by Dr. Maurice Wagner on the plateau of Tapia at the foot of Chimborazo. (In collection of the author and collection of the Museum of Munich.)

Observation.—The silvery hair of the clypeus is subject to fall off, especially in the middle of this piece. The clypeus is often, for this reason, only bordered with silver.

II. *First segment of the abdomen offering an anterior and a superior face; these two faces separated by a sort of transverse ridge or swelling (the true HYPODYNERUS).*

A. *Form much lengthened; first abdominal segment small, narrow, nodiform or pedunculiform, very much narrower than the 2d; its anterior face in a lengthened triangle.*—Metathorax with rounded angles; its excavation forming a wide vertical furrow.

48. *O. arcuatus* SAUSS.—Niger, velutinus, nigro-pilosus vel lævis, punctulatus; metanoto medio late canaliculato, polito; abdomine depresso; primo segmento trigonali, petiolato-campanulato, paene duplo angustiore quam secundum, supra transversim tumido, apicis puncto valde impresso; secundo nec supra nec subtus tuberculato; antennis nigris, subtus basi ferrugineis; punctulo frontis luteo; pronoti et abdominis segmentorum 1ⁱ, 2ⁱ margine postico, albido; tegulis pedibusque ferrugineis, his basi nigris; alis ferrugineis, apice fusco-cyaneis. —Longit. 15 mm.

♀. Clypeo subconvexo, nigro, apice recte-bicarinato, submarginato.

♂. Clypeo luteo, argentato, bidentato, lineola post-oculari albida; antennarum uncino et articulo præcedenti, ferrugineis.

Variat. Thoracis et abdominis lituris rudimentariis, incompletis, pæne nullis, vel pronoto nigro.

Odynerus arcuatus SAUSS. *Vespides*, I, 160, 45 (1852); III, 326.

This species can be regarded as the Chilian type of the genus *Nortonia*, and places itself in this genus, since all its characters attach it to the *Odynerus* of this division, but with a particular prolongation of the first abdominal segment.

It is most closely allied to *O. vestitus* and *excipiendus* (Comp. these species).

Hab. Chili.

49. *O. excipiendus* SPIN.—Niger, velutinus, *O. arcuato* simillimus, sed metanoto postice magis punctato; abdominis primo segmento superne minus tumido; secundo segmento medio in tuberculum producto; segmentis 1^o, 2^o luteo-marginatis, vel fere omnino nigris; antennis nigris; pedibus rufis, basi nigris; alis ferrugineis, apice fusco-cyaneis.—Longit. 14 mm.

♀. Clypeo nigro, planato, apice bidentato et carinulis 2 sinuatis instructo.

♂. Clypeo emarginato, luteo, nigro-piloso, utrinque nigro-marginato; antennarum uncino nigro.

Eumenes excipienda SPIN. in Gay's *Hist. fisic de Chile*, Zool. VI, 266, 1 (1851).

Odynerus excipiendus SAUSS. *Vespides*, I, 161, 47; III, 227.

Odynerus colocolo SAUSS. *ibid.* I, 161, 46 (1852); III, 227.—Gay's *Hist. fis. de Chile*, Zool. VI, Suppl. 566, 8 (1852).

In this species, the clypeus ♀ is black, flattened, with two sinuated carinæ, terminating in two apical teeth; the clypeus ♂ is luteous, bordered with black on the sides and superiorly; the antennæ ♂ are terminated by a sharp black hook. The thorax is quite black, excepting at times a little yellow line in the middle of the prothorax; the first two segments of the abdomen have often only a very narrow yellow line, which is sometimes wanting or only indicated by an incomplete line on the margin of the 2d segment.

Hab. Chili.

50. *O. subpetiolatus* SAUSS.—*O. arcuato* affinis; formis simillimus, sed minor; abdomine subpetiolato, secundo segmento haud tuberculato; primo segmento postice sublatiore; antennis, tegulis, pedibusque rufis; antennis apice griseis; puncto frontali luteo; pronoti margine antio

(haud postico) luteo-limbato; abd. segmentis, 1^o, 2^o luteo-marginatis; alis ferruginescentibus, apice infuscatis.—Longit. 13 mm.

♀. Clypeo nigro, apice bicarinato, submarginato.

♂. Clypeo elongato, emarginato, luteo, utrinque nigro-marginato; antennarum scapo superne nigro vel obscuro uncino minuto, rufo.

Odyn. subpetiolatus SAUSS. Vespides, I, 162, 4⁹ (1852).—III, 227, ♀ ♂.

Odyn. coarctatus SAUSS. Gay's Hist. física de Chile, Zool. VI, Suppl. p. 565, 7, ♀ (1852).¹

Hab. Chili.

51. *O. tuberculatus* SAUSS.—Major quam *O. arcuatus* eique formis affinis, sed thorace latiore; abd. primo segmento paulo latiore, supra postice sulco partito, et ante sulcum in cantho transverso tuberculo parvulo instructo; secundo segmento nec supra nec subtus tuberculato; post-scutello tantum in apice truncato. Niger, rugulatus, velutinus, hirsutus. Antennis ferrugineis, apice nigris; ore, pronoto, tegulis rufis; lineola post-oculari, pronoto medio frequenter, post-scutello et abdominis segmentorum 1ⁱ, 2ⁱ margine, luteis; alis ferrugineis, apice fusco-violascentibus.—Longit. 16 mm.

♀. Clypeo nigro, piriformi, satis planato, bicarinato, apice truncato, vel submarginato.

♂. Clypeo elongato, paulum bidentato, luteo; antennarum uncino apicali nigro; post-scutello nigro.

Odynerus tuberculatus SAUSS. Vespides, I, 163, 50 (1852).—Gay's Hist. fís. de Chile, Zool. VI, Suppl. 564, 6, 1852.—Vespides, III, 228.²

This species differs from *O. humeralis* in its smaller size; its antennæ ♂ terminated by a sharp black hook, not by a rufous spiral or a blunt hook. The clypeus is more narrow; in ♀ flattened, bicarinate; in ♂ not so sharply bidentate.

Hab. Chili.

52. *O. tuberculiventris* SPIN.—Minutus, *O. arcuato* formis similimus; sed pronoto lato, angulato; post-scutello haud truncato, postice angulato, vel arcuato; abdominis secundo segmento subtus basi tuberculo acuto instructo. Niger, velutinus; antennis, tegulis et pedibus rufis; his basi nigris; macula frontali, punctulo post-oculari margine antico, macula subalari, postscutelli et abd. segmentorum 1ⁱ, 2ⁱ, margine postico, luteis. Alis subhyalinis, venis ferrugineis, apice griseo.—Longit. 8 mm.

¹ This supplement appeared after my book I on Vespides; and hence I preserve the name *subpetiolatus* as being the older.

² In this paragraph of Vol. III, the affinities are not well given.

♀. Clypeo nigro, apice biangulato.

♂. Clypeo fere pentagonalij, luteo, bidentato; antennarum scapo superne nigro, subtus flavo; flagello apice flavescente; pedibus flavo-varis.—
Variat. Antennis supra nigrescentibus.

Eumenes tuberculiventris SPIN., Gay's Hist. física de Chile, Zool. VI, 267, 2 (1851).

Odynerus tuberculiventris SAUSS. Vespides, I, 162, 49; III, 227.

In the male, the femora are black, with rufous knees and with a yellow line; the tibiae are yellow on their anterior side.

Res. a. diff.—Differs from *O. labiatus*, in its luteous postscutellum; its black clypeus ♀; its polygonal shaped clypeus ♀, terminating in two small teeth; and its small size.

Comp. also *O. Chilotus*.

Hab. Chili.

B. *Form shorter, wider; first segment wide on its posterior border; its anterior face in the form of an equilateral triangle and a little pedicellate; its superior face large. Metathorax excavated, offering a trace of a polygonal plate surrounded with ridges.*

a. *Wings rufous along the anterior margin.*

53. *O. Molinæ* SAUSS.—Niger, hirsutus; antennis, clypeo, mandibulis, tegulis pedibusque, rufis; pronoto medio et fasciis 2 abdominis, luteis; abdominis primo segmento satis elongato, postice sat lato, secundo subtus basi paulum plicato; alis ferrugineis, apice fuscescentibus. ♀ Long. 14 mm.

Odynerus Molinæ SAUSS. in Gay's Hist. fís. de Chile, Zool. VI, 562, 3, ♀ (1852).

Odynerus Moliniæ SAUSS. Vespides, III, 251, 126 (1854).

Hab. Chili (Type in the Paris Museum).

54. *O. labiatus* HALID.—Sat validus, depressus; postscutello depresso, truncato, metanoto excavato; abdominis primo segmento superne lato, basi parum petiolato, facie antica trigonali, facie supera brevi, lata, sulco profundo partita, antice cantho hebetato, subprominulo marginata; secundo segmento subtus basi tuberculato. Niger, velutinus, pilis nigris hirsutus; thorace tenuiter punctato, etiam in metanoti excavatione equaliter rugoso; mandibulis, antennis, tegulis pedibusque rufis; pronoti margine antico (nunquam tantum in medio) et abdominis segmentorum 1ⁱ, 2ⁱ margine, luteis; alis ferrugineis, apice violascentibus.—Longit. 16 mm.

♀. Clypeo rufo, apice truncato vel subemarginato.

♂. Clypeo elongato, ovato, polygonali, luteo, apice sat late subemarginato.

Odynerus labiatus HALIDAY, Trans. Linn. Soc. XVII, 323 (1837).—SAUSS.
Vespides, III, 228.

Odynerus Lachesis LEP. ST. FARG., Hymenopt. II, 667, 44 (1841).—SAUSS.
Vespides, I, 164, 51, pl. xvii. fig. 5, ♀; III, 228.

Odynerus marginicollis SPIN. in Gay's Hist. fisica de Chile, Zool. VI,
256, 2 (1851).

Res. a. diff.—Differs from *O. humeralis* in its coloration; in its narrower form, in its finely punctured thorax, not rugosely shagreened, and in the little ventral tubercle which is not only a wrinkle like that of the *O. humeralis*, but is quite tuberculiform in the middle. In size it is much smaller. Differs from the *O. tuberculiventris* in its triple size; in the clypeus, ♀ rufous, ♂ prolonged, narrow (almost an ellipse, lengthened and notched at the end).

Hab. Chili.

55. *O. vestitus* SAUSS.—Niger, nigro-hirtus; metanoto hebetato; abdomine sessili; secundo segmento subtus tuberculato; pronoti margine antico et vittis 2 abdominalis, luteis; antennis nigris; alis subfuscoescentibus, costa basi subferruginea. Longit. 13 mm.

♀. Clypeo nigro, biangulato.

♂. Clypeo elongato, planato, luteo, apice arcuatim emarginato; antennis apice uncinato rufo.

Odynerus vestitus SAUSS. Vespides, III, 252, 127, ♀ (1854).

Res. a. diff.—Closely allied to *O. arcuatus* and *excipiens*, but differs clearly in its 2d abdominal segment, tuberculato beneath, and wider and longer than the first. In one specimen the wings are slightly smoky and ferruginous.

Hab. Chili.

56. *O. humeralis* HALID.—Validus, corpore lato, depresso, velutino, thorace ubique rugose granulato, etiam in metanoti excavatione; primo segmento latiore, basi paulum petiolato; dehinc trigono-infundibuliformiter dilatato, valde punctato; facie supera lata, sulco profundo partita; secundo segmento subtus basi transversim plicato-tuberculato.—Corpus nigrum, pilis fulvis vel fuscis longissimis hirsutum; mandibulis partim, pronoto, tegulis pedibusque rufis; abdomine fasciis duabus luteis; antennis in dimidio basali rufis, in dimidio apicali nigris, tarsis apice obscuris. Alis fusco-violaceis, costa et basi ferrugineis.—Longit. 20 mm.

♀. Clypeo nigro, subconvexo, lævi, apice subemarginato.

♂. Clypeo luteo argenteo-piloso, ovato, valde bidentato; labro fusco,

antennis apice subcochleatis uncino arcuato, obtuso, compresso, rufo, vel nigro-vario.

Odynerus humeralis HALIDAY, Trans. Linn. Soc. XVII, 324 (1837).—
SAUSS. Vespides, III, 228.

Odyn. chilensis LEP. ST. FARG. Hymen. II, 643, 28 (1841).—SPINOLA in
Gay's Hist. fis. de Chile, Zool. VI, 255, 1.—SAUSS. Vespides, I, 166,
54, pl. xvii, fig. 6; III, 228.

This large species has some very salient *lateral* ridges upon the metathorax; the superior ridges of the concavity are saliently indicated, especially among the males, but the rugosities which cover the metathorax as well as the remainder of the thorax render them obtuse and indistinct. The antennæ ♂ terminate in a blunt rufous hook or in a longitudinal spiral; the clypeus ♂ is terminated by two rather long spines, and in the male the tarsi are mostly blackish. It is, however, closely allied to *O. tuberculatus*. Comp. this species.

Hab. Chili, and the western coast of South America.

57. *O. Tarabucensis* SAUSS.—Validus; *O. humerali* similis; niger; pronoti margine antico et abdominis fasciis duabus, luteis; antennis nigris, scapo rufo; tegulis nigris; mandibulis et pedibus, rufis; alis ferrugineis, apice violascentibus.—♀?

♂. Clypeo luteo, apice dentibus 2 distantibus armato.

Odynerus Tarabucensis SAUSS. Vespides, III, 250, 125, ♂ (1854).

Hab. Bolivia (I do not possess this species. Type in the Mus. of Paris).

b. Wings fuscous, with violet iridescence.

58. *O. albocinctus* PULS.—Niger, velutinus, nigro-hirsutus. Clypeo piriformi nigro, apice valde bidentato; antennis, mandibulis et labro, rufis; metathorace rotundato; abdomine pilis nigris longis sparso, tantum primo segmento anguste albido-limbato; secundo segmento snbtus laud tuberculato; pedibus rufis, femoribus postice nigris; alis fusciscentibus, violascentibus præcipue apice; tegulis nigris. ♀. Long. 20 mm.

Odynerus albocinctus PULS & STROBEL, Atti della Soc. Italiana de Sc. Nat. XI, 1868, 256, ♀.

Hab. The Argentine Republic. Province of Mendoza.

This is the only species of the type *Hypodynerus* found as yet on the Oriental side of the Andes.

The form not having been described, I cannot assign to this

species its place with perfect certainty in the subdivisions of this group.

C. *Form very wide, short and depressed, first segment very wide; its anterior face sessile, in the form of a wide triangle; its superior face very short, 3-4 times as wide as long.*

a. *Wings wholly obscure, violet.*

59. *O. villosus* SAUSS.—*O. Antucensi* staturâ, formis et facie affinis, sed pronoto et capite angustioribus; crassus, ater, velutinus, valde nigro hirsutus; metanoti excavatione polita; abdomine sessili; primo segmento lato, breviter truncato; secundo subtus basi eminente plicato; mandibulis, antennis et pedibus rufis; his basi et fere usque ad genua nigris; tegulis nigris, rufo-maculatis; abdominis vittis 2 luteis angustis; alis infuscatis, violascentibus.—Longit. 15 mm.

♀. Clypeo nigro, lævi, apice punctato, paulum emarginato.—♂ . . . ?

Odyn. villosus SAUSS. Vespides, I, 165, 53, ♀ (1852).—GAR'S Hist. fisic de Chile Zool. VI, Suppl. 563, 4 (1852).

This may be a variety of *O. obscuripennis*.

Hab. Chili.

60. *O. obscuripennis* SPIN.—*O. villosus* similis, sed major, thorace rugoso, granulato; ater, villosus; antennis nigris, scapo rufo; pedibus rufis vel nigrescentibus, basi nigris; abdomine fasciis 2 luteis.—Long. 18 mm.

Odyn. obscuripennis SPIN. in Gay's Hist. fisic de Chile Zool. VI, 259, 4, ♀ (1851).—SAUSS. Vespides, I, 165, 52; III, 228.

Odyn. Coquimbensis SAUSS. in Gay's Hist. fisic de Chile Zool. VI, Suppl. 561, 1 (1852).

Hab. Chili (Type in the Paris Museum).

This species not being in my possession, I cannot give a complete diagnosis of it.

b. *Wings ferruginous with the apex fusco-violaceous or fuscous, and the anterior margin rufous.*

61. *O. Antucensis* SAUSS.—Crassus, velutinus, pilis nigris longissimis valde hirsutus. Corpus depressum; thorace quadrato, tenuiter punctato; post-scutello et metanoto verticaliter truncatis, hujus facie postica trigonali, fere plana, parum late excavata, ut reliquis thorax velutinorugulosa, canthis obtusis marginata. Abdomine lato, depresso, sessili; primo segmento antice valde truncato, faciem antioam trigonalem et faciem superam brevissimam et latissimam præbente; facierum illarum concursus canthum transversum efficiens; facie supera sulco partita;

2^o segmento paulo latiore quam primum, subtus basi plicato-tuberculato. Niger; mandibulis, tegulis, pedibus et antennis, rufis; his apice supra grisescentibus; abdominis primo segmento luteo-marginato; alis ferrugineis apice fusco-violascentibus.—Longit. 15 mm.

♀. Clypeo elongato, rufo, apice bicarinato submarginato, utrinque nigro-marginato.—♂?

Olyn. Antuco SAUSS. Et. Vespides, I, 167, 55, ♀ (1852).—GAR'S Hist. fis. de Chile, Zool. VI, Suppl. 562, 2 (1852).

Odyn. Antucensis SAUSS. Et. Vespides, III, 228.

Ress. a. diff.—This species is closely allied to *villosus*, but its body is thicker; the thorax is quadrate and wide anteriorly; the color of the wings and clypeus ♀ is different.

Hab. Chili.

62. *O. Chilotus* SAUSS.—Niger, velutinus, nigro-hirtus; *O. Antucensis* affinis; thorace brevi; metanoto late excavato, canthis marginato, utrinque angulato; abdominis secundo segmento subtus valde tuberculato; segmentis 1^o, 2^o margine luteo; antennis et pedibus rufis; tegulis nigris; alis fusco-violascentibus, costa ferruginea.—Longit. 11 mm.—♀?—♂. Clypeo elongato, bidentato, luteo.

Odyn. chilotus SAUSS. Vespides, I, 167, 56, ♂.—In GAR'S Hist. fis. de Chile, Zool. VI, Suppl., 566, 9.—Vespides, III, 229.

I do not possess this species, which seems much like *O. Antucensis*. But I cannot think it the male of that, because of its biangulate metathorax. The first abdominal segment seems to have on its anterior face something like a suture, which allies it to the subgenus *Ancistrocerus*.

Hab. Chili (Paris Museum).

63. *O. ruficollis* SPIN.—Ater, velutinus, nigro-hirsutus, crassus et brevis; abdomine basi valde truncato, lato; metanoto rotundato; abdominis 2^o segmento subtus basi plicato-tuberculato; antennis, pronoto, tegulis, pedibusque, ferrugineis; abdomine fasciis 2 luteis; alis ferrugineis, apice fusco-nebulosis.—Longit. 11 mm.

♀. Clypeo biangulato, rufo, nigro-marginato.—♂?

Odyn. ruficollis SPIN. l. l. VI, 259.—SAUSS. Et. Vesp. I, 168, 57, ♀.

I do not possess this species. By its livery, it would seem a miniature of *O. humeralis*, but the abdomen is more sessile, the clypeus ♀ is rufous; the metathorax is rounded, not sharp, on its margins, etc. The form is more that of *O. Antucensis*.

Hab. Chili (Type in the Paris Museum).

64. O. Maypinus SAUSS.—Niger, hirsutus; antennis, tegulis, pedibusque rufis; abdomine fasciis 2 luteis, primo segmento sessili, lato et brevi; alis ferrugineis, apice violascentibus.—Longit. 13 mm.—♀?—♂. Clypeo paulum bidentato, luteo.

Ab *Odyn. Antucensi* differt, metanoto rotundato, marginibus hebetatis (num ejus masculus?).

Odyn. Maypinus SAUSS. *Vespides*, I, 169, 58, ♂ (1852).—In Gay's Hist. fis. de Chile, Zool. VI, Suppl. 564, 5 (1852).—*Vespides*, III, 229.

Hab. Chili (Type in the Paris Museum).

D. *Form also quite chubby, but not so much depressed; metathorax rounded, flat or convex behind, smooth, without marginal edges; abdomen arched (vespiform); first segment very short; its superior face transverse-linear. (Appearance of a VESPA.)*

65. O. vespiformis HALID.—Niger, parum depressus, nitidus, pilis, longissimis nigris hirsutus; capite et thorace nitidis, tenuiter punctatis; post-scutello breviter truncato; metanoto rotundato, convexo, punctato; thorace quadrato-globoso; abdomine perfecte sessili (ut in genere *Vespa*) superne convexo; primo segmento brevissimo, antice excavato, subexciso; secundo subtus basi valde tuberculato; punctulo frontis luteo; antennis pedibus et tegulis rufis; pronoti margine postico et abdominis segmentorum 1ⁱ, 2ⁱ limbo, luteis; alis ferrugineis apice subinfuscatiss. —Longit. 13 mm.

♀. Clypeo nigro, apice rugoso, punctato, bicarinato, truncato;

♂. Clypeo luteo, punctato, bidentato; mandibulis antice fascia flava; antennarum uncino minuto.

Variat. Thorace et abdomine fere omnino nigris, fasciis rudimentaris vel nullis.

Odyn. vespiformis HALID. Trans. Linn. Soc. XVII, 323 (1837).

Odyn. hirsutulus SPIN. in Gay's Hist. fis. de Chile, Zool. VI, 257, 3 (1851).

—SAUSS. *Vespides*, I, 212, 118; III, 244.

Ress. a. diff.—This species is rendered very distinct by its less depressed form, and its quite sessile abdomen, which gives it the appearance of a *Vespa*. The first segment is so short, that the superior face is almost wanting; its anterior face presents as in *Vespa* a sort of obsolete notch at its summit, which is an impression of the post-scutel. The anterior face has not the triangular form, its superior margin being arcuate as in the *Vespa*.

Hab. Chili (A common species).

Division PACHODYNERUS.

SAUSS. III^e, Divis. Sect. I^o, Vespides, I, 169.—Divis. *Epsilon*, Sect. I,
ibid. III, 229, 252.

Form relatively blunted (stubbed). Antennæ of males simple, not being terminated by a hook. Thorax short, in form of a long or even cubical square, truncate posteriorly. The post-scutellum transversely truncate, offering for this reason a superior horizontal and transverse face and a posterior vertical face, which makes a division of the posterior concavity of the thorax; these two faces being separated by a transverse ridge formed by their meeting. Abdomen always sessile, conical, truncate at its base. (The first abdominal segment less coarsely punctured than the 2d, more smooth.)

Among the insects of this division the forms are very thickset, short, and stubbed. The clypeus of the females is widened and rounded at the summit, as wide as long, pear-shaped, and truncate at the extremity; the angles of the truncation are often a little salient, dentiform, and sometimes the clypeus appears bidentate by reason of a little fossette which occupies its extremity. Among the males this piece is most often polygonal, truncate, as wide as long.

The thorax is very cubical, with little or no retraction behind. The metathorax never prolongs itself beyond the post-scutel, but is briefly truncate; its truncation encroaches strongly upon the post-scutel and gives birth to a smooth plate which occupies most of its width; this plate is polygonal, often armed with two lateral teeth, and bordered by some sharp or blunted ridges, which become especially salient upon the latero-superior borders, where they form on each side a sort of arcade, and are often terminated by a projection, separated from the post-scutellum by a fissure. Among these species having a thorax very square and widened behind, this character is well developed, but the ridges do not bend at the middle to form a re-entering angle under the angle of the post-scutel (as among the *Ancistrocerus*), but are effaced at the entrance.

The post-scutellum seen above is almost linear, truncate vertically, and its posterior face makes a division of the posterior plate of the thorax; its ridge is sharp and often crenulate. The

abdomen is perfectly sessile, conical; its first segment is wide, often quite as wide as the 2d, squarely truncate at its base, which permits the distinction of an anterior and a superior face; the transverse ridge which results from this truncation is sometimes blunted, sometimes sharp. The superior face is always transverse, wider than long. The abdomen is sometimes velvety, sometimes smooth, shining, not rugose, and the first segment is wholly smooth, less punctured than the 2d.

It is fitting to say that for each one of these characters, there may be met some exception among this and that species.

Of all the *Odynerus*, the species of this Division have the most cubical thorax and the most conical abdomen. Yet they have almost the same form as a great part of the species of the Division *Odynerus* which follows, and are only distinguished from them by the antennæ of the males, which are destitute of the terminal hook. Owing to this circumstance the *Pachodynerus* occupy among the *Odyneri* a sort of typical position like that of the *Eumenes* of Division *Omicron*, these being also distinguished from the other *Eumenes* by the simple flagellum of the antennæ of the males. The *Pachodynerus* are also, like the *Eumenes* of the Division *Omicron*, peculiar to tropical and temperate America.

The *Pachodynerus* cannot easily be confounded with the *Stenodynerus*, because of their thick body and conical, thick abdomen. But, to make certain, one should consult the tables of the species of the Division *Odynerus*, which are placed before these Divisions.

Table to assist in distinguishing the species of the Division PACHODYNERUS.

- | | |
|--|-----------------------------|
| 1. Ornaments of the body all yellow. | |
| 2. Abdominal segments all margined with yellow, except the first. | |
| 3. Thorax wholly black. | |
| 4. Metathorax rounded, destitute of lateral angles. | 69. <i>argentinus</i> . |
| 4, 4. Metathorax forming an angle on each side. | |
| 5. Thorax elongate, metathorax with four spines; insect black. | 80. <i>diabolicus</i> . |
| 5, 5. Thorax cubical; metathorax with two angles; insect velvety, grayish. | 66. <i>brevithorax</i> . |
| | 66. { <i>brevithorax</i> . |
| 3, 3. Thorax with yellow ornaments. | 67. { <i>nasidens</i> . |
| | 68. { <i>simplicornis</i> . |

- 2, 2. The first abdominal segment margined with yellow.
3. All the segments margined with yellow
4. Prothorax all yellow. 72. *Guadulpensis*.
- 4, 4. Prothorax margined with yellow. 72. *Guadulpensis*.
5. The posterior margin of prothorax yellow. 73. *zonatus*.
76. *La Platae*.
- 5, 5. Only the anterior margin of prothorax yellow.
6. Thorax wholly or nearly black; abd. much truncate at base. 70. *Peruensis*.
- 6, 6. Thorax slightly ornamented with yellow; abdomen more ovate. 71. *brachygaster*.
- 3, 3. Only the first two segments margined with yellow or luteous.
4. The following segments rufous. 78. *cubensis*.
- 4, 4. The following segments black.
5. The posterior margin of prothorax, or both margins, yellow.
6. Ornaments whitish. 74. *Gayi*.
79. *californicus*.
- 6, 6. Ornaments yellow. 75. *præcor*.
76. *La Platae*.
- 5, 5. Only the anterior margin of prothorax yellow.
6. Ornaments whitish.
7. Insect short, thorax cubical. 74. *Gayi*.
- 7, 7. Insect more slender, thorax longer than wide. 79. *californicus*.
- 6, 6. Ornaments yellow, insect not so stout. 77. *tibialis*.
- 1, 1. Body more or less adorned with rufous.
2. Prothorax and first abdominal segment, etc., rufous. 81. *Erinnys*.
- 2, 2. Only the extremity of the abdomen rufous. 78. *cubensis*.

Description of the species.

1st. SECTION.—*Thorax cubical (at least among the males) or square, more lengthened. Abdomen conical; the first segment very large, as wide as the second.*

In this group one finds the most thick-set forms in the whole tribe of solitary wasps (*O. nasidens*, *O. Gayi*), the thorax becoming perfectly cubical, as in the *Nectarinia*, among the social wasps. However, among the most part of the species the forms do not differ essentially from those of the insects of the division *Odynerus*.

A. *All the segments except the first, bordered with yellow.*

These *Odynerus* have the body silky and adorned with beautiful golden reflections, or they are covered with a velvety satin which often conceals the punctures. They have a close resemblance among themselves, so that, without comparing numerous specimens, one easily confounds all under the same description, taking them for the *O. nasidens* of Latreille. This happened to me at the beginning of my studies. When new specimens arrived, I thought to distinguish many more species, and I have established differences in the diagnoses which are far from satisfying me. In fine, the increase of my collections has revealed to me such differences of size, of color, and of details of form, that, after having believed for a time that some species were distinguished with clear precision, I have perceived that nothing is more obscure than the limits of these species. A new examination of my very numerous specimens, far from clearing up the chaos, only results in filling me with new doubts; for, contrary to what one usually observes, the species do not appear to class themselves according to their geographical distribution; in lieu of finding one species from Mexico and another from Brazil, I find two species equally diffused in the two divisions of the American continent. In the midst of this confusion I think, however, that I can distinguish the *O. brevithorax* quite clearly, as there is here quite a difference from other species, in the form of the clypeus, etc.

The appearance of these insects recalls very much that of certain other Vespidae which have also their bodies velvety and silky and which inhabit the same hot regions. Such as certain *Ancistrocerus* (*A. Aristæ*, *Parredesi*); certain *Nectarinia* (*N. mellifica*), and even certain *Chartergus* (*Ch. chartarius*); with which one should be careful not to confound the *Odyneri* described below.

a. *Metathorax forming a lateral angle on each side.*

66. *O. brevithorax* SAUSS.—Niger, punctatus, ubique tomento velutino aureo-sericeo indutus; thorace cubico, latitudine longitudini æquali; metanoto in tota latitudine excavato; ejus excavatione lævi, sericea, canthis acutissimis marginata, utrinque in dentem lateralem excurrentibus; abdomine perfecte conico, sericeo; primo segmento bre-

vissimo; antennarum flagello subtus et scapo apice, ferrugineis; tegulis testaceo-maculatis; abd. segmentorum 2-5 margine late flavo, et valde punctato; primo nonnunquam etiam tenuiter flavo-marginato; tibiis antice flavo vel fulvo-variis; alis ferrugineis, apice griseis.—Longit. 10 mm.

Variat. Metanoti canthis flavis.

♀. Clypeo punctato apice, *dentibus* 2 *acutis*, inter se distantibus armato; punctis 2 fulvis in dentibus et 2 in angulis superioribus ornato.

♂. Clypeo in marginibus argentato; apice fere ut in ♀ bidentato, vel emarginato, *dentibus* 2 trigonalibus terminato; apice lineis 2, in summo fasciis 2 lateralibus, flavis; labro flavo; mandibularum margine externo et scapo, linea flava instructis.

Variat. Clypeo in lateribus flavo-marginato; oculis intus flavo-marginatis, pedibus nigris.

Odynerus brevithorax SAUSS. *Vespides*, I, 172, 62¹ (1852); III, 231.—*Rev. Zool.* X, 1858, 166.

The teeth of the clypeus ♀ are spiniform and separated by an arched margin, not angularly notched. The thorax is cubical, not longer than wide; the disk of metathorax is much broader than long, in the form of a half circle; its margins are arcuated anteriorly, not sinuated. The scutel is square, rather elevated, and the post-scutel is situated a little lower, while in *auratus*, the scutel is more flattened and the post-scutel is on the same plane.

Res. a. diff.—Compare *O. nasidens* and *simplicornis*, *O. diabolicus*, and also *Ancistrocerus Aristæ* and *Paredesi*.—This species, as well as the following, must be carefully distinguished from different species of *Nectarinia*;² this may easily be done, from their very wide first abdominal segment, not very small and shortly petiolate; from their distinct post-scutel, and the truncate, not angulate, apex of the clypeus.

Hab. South America. Brazil. Bahia, 2 ♀, 3 ♂.—Venezuela ♀ ♂.

67. *O. nasidens* LATR.—*O. brevithoraci* simillimus; statura variabili; thorace longiore quam latiore; pronoti margine postico, post-scutello, abdominisque segmentorum 2-6 margine ochraceis; alis ferrugineis, apice griseis.

♀. Clypeo apice latius bidentato, magis biangulato; *dentibus* fulvis; interdum superne maculis 2 fulvis vel omnino flavis.

¹ The figure which bears the same name belongs to the *O. nasidens*.

² Social wasp.

♂. Clypeo polygonali, late truncato, margine utrinque flavo, vel omnino flavo, macula nigra.

Odyn. nasidens LATR. Voyage de Humboldt, Zool. II, 112, pl. xi, fig. 1, 2,

♀.—SAUSS. Vespides, I, 171, 61, 1852; III, 230.—Rev. Zool. X, 1858, 165, 1.—PACKARD Rep. Peabody Acad. 1869, 5.

Odyn. auratus SAUSS. Rev. Zool. X, 1858, 166.

Odyn. brevithorax SAUSS. Vespides, I, pl. xvii, fig. 9, ♀.¹

♀. Total length, 13 mm.; wing, 11 mm.

♂. Total length, 10 mm.; wing, 7.5 mm.

Var. minor.—♀. Total length, 10 mm.; wing, 7.5 mm.

♂. Total length, 7 mm.; wing, 6.5 mm. .

Of variable size, sometimes larger than the *O. brevithorax*, sometimes of the same size. Head densely punctured. Thorax longer than wide, densely cribose; post-scutel linear above, finely crenulate, metathorax very squarely truncate; its concavity occupies the whole width, is smooth, silky, and a little striate, bordered above by some arcuate, very trenchant ridges, which abut upon the two extremities of the post-scutel within, but which are not as well separated from it by fissures as the *O. brevithorax*; from each side a dentiform angle turns downward. Abdomen perfectly conical; the first segment very large; quite long, being notably more so than in the *O. brevithorax*, where it only forms a cup, not a bell.

Insect black, clothed in a beautiful velvet, of silky hair, having golden reflections, which are only distinct among the well-preserved specimens. Mandibles ferruginous at the end, spotted with yellow at the base. Two spots at the extremity of the clypeus and one at the extremity of the scape, post-scutel, ridges of the metathorax, and a regular border upon segments 2–5 of the abdomen of a yellow-ochre, a little golden; border of these segments strongly punctured; anus bordered with yellow; wing scales marked or bordered with testaceous; knees and end of tarsi a little ferruginous; anterior tibiæ marked with yellow before. Wings ferruginous with the end gray.

♀. Clypeus pyriform, rugose, strigose-punctate, terminated by two diverging or biangulate teeth.

Var. a. Clypeus yellow, or margined with yellow, or with two yellow spots on the top.

b. A yellow line on the scape.

¹ Only the figure, not the description.

- c. A yellow spot on each side between the eye and the clypeus.
- d. Prothorax slightly bordered with yellow on its anterior angles.
- e. Prothorax not bordered with yellow, with quite golden reflections.

f. Antennæ quite black. (Bahia.)

g. Tibiæ with yellow lines or wholly black.

♂. Clypeus polygonal, argenteous, widely margined with yellow on both sides; its anterior margin widely truncate. Antennæ fulvous beneath; the scape with a yellow line; lower part of the eyes bordered with yellow.

Var. Clypeus quite yellow, with a black spot or line in the middle.

Mexican variety. ♀.—Mandibles black to the end. Antennæ ferruginous beneath, except at the extremity, and becoming brown ferruginous. Tibiæ all ornamented with yellow. There are often two yellow dots on the front; the teeth of the clypeus only, red.—Mexico.

Small variety. ♀.—Of the size of the *O. brevithorax*, but offering the same characters as the above variety. Borders of the metathorax more rounded.—♂. Antennæ and legs as in the ♀ variety.—Mexico.

Ress. a. diff.—This species differs from the *O. brevithorax*, in its greater size, in its thorax longer than wide although very square, in its clypeus ♀ less wide, but strongly bidentate, in the disk of the mesothorax a little attenuated before, having the latero-anterior borders a little sinuate. The male differs, by its polygonal clypeus, truncate, not bidentate.

It approaches yet more closely to *O. simplicicornis*.—Compare these species.

Hab. Tropical America. I possess a great number of specimens. 1st. From the hot parts of Mexico (Huasteca, Oriental Cordillera, Michoacan, etc.); 2d. From Colombia and Venezuela; 3d. From Bahia and Brazil. They do not appear to me to differ specifically.

Although the description given by Latreille of his *O. nasidens* does not agree well with our specimens, we do not retain any doubt as to the identity of the species. The description of Latreille is evidently a hybrid description, being partly of a female, partly of a male. When he said that the clypeus was bidentate,

he had seen the female of it; when he said "bordered with yellow," he had seen the male, which he may have taken for a female, because the antennæ do not possess a hook.

According to Latreille, the prothorax is ornamented with yellow on the anterior border, and it has a yellow dot behind the eyes, but we suppose that he was rather troubled about the golden reflections.

This unfortunate description of Latreille has caused me to lose infinite time in vain researches, without the least result, so that I have finally brought myself to announce the above opinion which I think to be the only correct one.

68. *O. simplicicornis* SAUSS.—*O. nasidenti* simillimus, sed thorace paulo brevior et clypeo in utroque sexu truncato, haud distincte emarginato, ♀ apice flavo-bipunctato, ♂ flavo-marginato.

Odynerus simplicicornis SAUSS. Vespides, III, 253, ♂ (1854); Id. Sagra's Hist. de Cuba, Ins. 771, pl. 19, fig. 5.—Rev. Zool. X, 1858, 166 (faulty).—CRESSON, Philad. Ent. Proceed. II, 1865, 165.

♀. Total length, 11 mm.; wing, 9 mm.

♂. Total length, 8 mm.; wing, 7 mm.

♀. A little smaller than the large variety of the *O. nasidens*; the same color, the same velvety and silky aspect. Clypeus a little striate, less strongly punctured, truncate at the extremity, but biangulate, often a little bidentate. Thorax a little longer than wide; shorter than with the *O. nasidens*, longer than with the *O. brevithorax*; metathorax as with the *nasidens*, finely striate. Abdomen as with the *O. nasidens*. Antennæ ferruginous beneath in their first moiety; a yellow dot on the summit of the mandibles, two at the base of the clypeus, and often two more on the front; posterior border of the prothorax, often the anterior also, post-scutel, superior ridges of the metathorax, and border of the segments 2–6 yellow; tibiæ often ornamented with yellow. Wings ferruginous, with the end gray.

♂. Smaller; clypeus polygonal, truncate, offering at the two extremities of its inferior border a marked angle, more decided than in the *O. auratus* ♂; its lateral and inferior borders, yellow; a yellow line on the scape and in the sinus of the eyes. Yellow ornaments of the thorax indistinct.

Revs. a. diff.—Differs from the *O. brevithorax* by its clypeus, which is not strongly bidentate, and by the yellow ornaments of

the thorax. One should perhaps consider this species as a variety of the *O. nasidens*? yet it appears to us to constitute a local species.

Hab. The isle of Cuba. 6 ♀, 3 ♂.

"The nest of this species is somewhat of an oblate spheroidal shape, constructed of fine earth, of a beautiful fawn-color. It is attached to a slender twig and measures $4\frac{1}{2}$ by 6 lines; sometimes two nests are attached close together, to the same twig; the outer surface is uneven, and on the upper side there is a stout peduncle, by which the nest has been attached to another body. The opening made by the imago in its escape is large and always on the side of the nest." (Cresson, l. c.)

b. Metathorax rounded, not forming on each side a dentiform angle.

69. *O. Argentinus* SAUSS.—Niger, confertim punctatus; metanoto postice rugoso, rotundato, utrinque angulo nullo; superne utrinque acute-marginato, canthis a post-scutello fissura sejunctis; pronoti abdominisque segmentorum 2^a–5^a margine postico flavo-limbato; alis hyalino-ferrugineis, apice grisescentibus; tegulis ferrugineis.—♂. Clypeo truncato, flavo; puncto frontali; scapo subtus, tibiis antice, flavis.

Odyn. Argentinus SAUSS. Rev. et Mag. de Zool. XXII, 1870, 56, 6 ♀.

♀. Total length, 11 mm.; wing, 9.5 mm.

♂. Total length, 10 mm.; wing, 8 mm.

♀. Head and thorax densely and rugosely punctured, shagreened; the punctures small. Thorax a little longer than wide. Post-scutel truncate, very short and transverse, crested and a little crenulate. Metathorax posteriorly excavated, rugose, but with arcuate edges, circular, forming no lateral angle whatever; the lateral ridges sharp in their upper half, each terminating in a tooth separated from the post-scutel by a deep fissure. Abdomen of equal width from base up to the end of the second segment, its base truncate and rounded; the whole very finely punctured, with very short hair and with sericeous gray pile; the hinder margin of 2d segment sometimes slightly depressed or very slightly canaliculated, and a little more strongly punctured than the base.

Insect deep black, with very short gray hair. Antennæ black; a line on the hinder margin of prothorax and a regular band on the hinder margin of segments 2–5 yellow; beneath only a mark on each side of the margin of the 2d segment; tegulæ margined with yellow or ferruginous. Anus black. Legs black; articu-

lations and hooks a little rufous. Wings subhyaline or smoky; the anterior margin rather ferruginous.

Var. a. A little yellow mark on the forehead.

b. A little yellow line in the middle of the margin of the 1st segment.

c. The post-scutellar metathoracic eminences indistinct or not developed.

♀. Clypeus convex, strigate, bicarinate, terminated by two angles or teeth, sometimes ferruginous.

♂. Clypeus rounded, polygonal, pale yellow, widely truncate, its inferior angles almost toothed. A line on the mandibles and on the scape of the antennæ, a spot between the antennæ, inner orbits, a line on the anterior side of the tibiæ, pale yellow or ferruginous. Antennæ without a terminal hook.

Var. a. Only the 2d, 3d, and 4th abd. segments margined with yellow.

Res. a. diff.—This insect has the appearance of *O. diabolicus*, but it is a little larger and is easily distinguished from it by its metathorax, destitute of lateral angles, but having elevated ridges separated by fissures from the post-scutel. The clypeus ♂ is more truncate; its inferior margin being wide.—It differs also from *O. brachygaster*, by its metathorax without angles, and by its deep black, not grayish color—velutinous as in *O. nasidens* and its allies.

Hab. The Argentine Republic. Buenos Ayres. 7 ♀, 5 ♂.

B. *All the abdominal segments margined with yellow or rufous.*

a. *Superior edges of metathorax not sharp.*

70. *O. Peruensis* SAUSS.—Niger, cinereo-sericeus; thorace antice latiore quam postice; metathorace excavato, strigato, inferis tantum canthis acutis; abdomine conico, basi lato, truncato, 2ⁱ segmenti margine crasse punctato; post-scutelli et metanoti punctis 2 minutis, abdominisque segmentorum limbo late, pallido-flavis; 2ⁱ fascia utrinque aucta; femoribus tibiisque obscure rufis; alis subhyalinis, costa subferruginea. Longit, 11–12 mm.

♀. Clypeo rotundato, emarginato, valde punctato, dentibus 2 distantibus terminato.—♂. Clypeo truncato.

Odyn. Peruensis SAUSS. Et. Vesp. III, 253, 129, pl. xii, fig. 4, ♀ (1854).

Hab. Peru. (Typus in Mus. Parisiensi.)

b. Superior edges of metathorax sharp.

71. *O. brachygaster* SAUSS.—Niger, valde punctatus, omnino fulvo-velutinus; metathoracis excavatione lata, lævi, argenteo-sericea, utrinque obtusangulata, superne canthis arcuatis acutis marginata; his a post-scutello per fissuram utrinque sejunctis; abdumine ovato, basi truncato; capite omnino nigro; pronoti marginibus obsolete, tegulis partim, post-scutello, puncto subalari et punctis 2 in angulis scutelli, metathoracis canthis superioribus abdominisque segmentorum 1^o–5^o limbo, fulvis; primi fascia angusta, 2^a lata; 2^a margine late crasse punctato; pedibus nigris, artibus, tarsis et mandibularum apice obscuro-rufescentibus; tibiis anticis fulvo-variis; alis subhyalinis, basi et costa subferrugineis apice griseis.—♀. Clypeo bidentato, dentibus inter se distantibus, rufis.—♂ ?.

Odyn. brachygaster SAUSS. Et. Vesp. I, 173, 63, pl. xvii, fig. 8 (1852).
—Rev. Zool. V, 1858, 167, 5.

Var.? Margins of the abdominal segments narrow; antennæ ferruginous beneath; wings hyaline, with fuscous veins.

Very similar to *O. nasidens*; but also very distinct, the abdomen not being as conical and the 2d segment more elongate; the antennæ are also more slender.

Hab. Brazil. (Paris Museum and coll. of author.)

This can be well distinguished from *Chartergus chartarius* (social wasp) by its truncate or bidentate clypeus (not angulate), its long mandibles, its wider first abdominal segment, etc.

72. *O. Guadulpensis* SAUSS.—Niger, valde punctatus; capite et thorace rugosis, abdominis segmenti 2^a margine et sequentibus valde punctatis; linea mandibularum et scapi, macula frontali, pronoto omnino superne, tegulis, macula subalari, maculis 2 scutelli, post-scutello metanoto utrinque, flavis; abdominis segmentis 1^o, 2^o flavo-marginatis, primi fascia utrinque aucta; segmentis 3–5 superne fulvo, subtus flavo, tenuiter limbatis; tibiis et tarsis flavis; alis flavescentibus apice infumatis.—♀. Clypeo flavo, nigro-maculato.—♂. Clypeo truncato, polygonali, flavo.

Variat. Pronoti angulis posticis nigris.

O. cubensi affinissimus; ab illo distincte differt: statura paulo minore; mandibulis nigris, flavo-notatis; pronoto frequenter omnino flavo; antennarum scapo nigro, linea flava ornato; coxis et femoribus nigris; abdominis primo segmento *hæud acute truncato*¹; segmentis 3–6 nigris tenuiter flavo-marginatis.

Odyn. Guadulpensis SAUSS. Et. Vespides, I, 182, 76 (1852).

¹ In our ♂ specimen the first segment offers a sort of suture, but this, I think, may be a mere accident of puncturation.

Res. a. diff.—In this species the clypeus ♂ is hexagonal, as broad as long, truncate, while in *O. cubensis* ♂ it is longer than broad, bidentate, and its greatest width is situated lower than the middle. The abdomen is not as conical, not sharply truncate at base; the hinder margin of the 2d segment and the following are more roughly punctate, etc.

73. *O. zonatus* SAUSS.—Niger, punctatus; thorace quadrato, paulo longiore quam latiore, metanoto excavato, acute marginato, biangulato; puncto frontali, pronoti margine antico et postico, macula subalari, tegulis, scutelli punctis 2, post-scutello, metanoti canthis, abdominis segmentorum margine, tibiisque partim, flavis; alis nebulosis.—♂. Clypeo polygonali flavo, argentato; antennis subtus ferrugineis, scapi linea flava.—♀?

Odyn. zonatus SAUSS. Revue de Zool. XXII, 1870, 57, 8, ♂.

Total length, 11 mm.; wing, 8 mm.

Head and thorax cribose. Thorax square, a little longer than wide. Its anterior margin concave, its angles rather produced, but not acute. Post-scutel truncate. Metathorax much excavated; its edges very sharp, forming on each side an angulated tooth. Abdomen conical, truncate anteriorly (but not sharply); the margin of 2d segment and those following strongly punctate.

Black, with short fulvous, but not velutinous hair; a spot on the mandibles and a dot between the antennæ, a narrow band on the anterior margin of prothorax, a wider one on the posterior margin, a spot under the wing, wing scales, a spot on each side of the scutel, post-scutel, and the ridges of the metathorax, yellow; all the segments of the abdomen margined with yellow, the fasciæ of the first two segments the widest; that of the first a little wider on the sides. Knees and tibiæ outside and the first tarsi, yellowish. Wings cloudy.

♂. Clypeus polygonal, truncate or submarginate, yellow, silvery; labrum and scape beneath, yellow; the remainder of antennæ ferruginous below; emargination of the eyes argenteous.

Res. a. diff.—This species comes very near to *O. præcox* SAUSS., and may be a local variety, with all the segments margined with yellow, or even a variety of *O. gadulpensis*, with the ornaments reduced.

Hab. Cayenne. (Author's collection.)

Observation.—The extremity of the antennæ being broken off,

we are not sure that this insect belongs to this group, although the appearance is quite that of *O. cubensis* and neighbors. It might possibly go to the group of the *Odyneri* with hooked ♂ antennæ?

C. *Only the first two abdominal segments margined with yellow.*
(*The 3d and 4th sometimes indistinctly marginate.*)

74. *O. Gayi* SPIN.—Crassus, thorace quadrato, postice late excavato, obtusangulato; abdomine brevi, lato, conico, basi truncato, primo segmento secundo æquilato; macula frontali, orbitis internis, scapo subtus, pronoti margine antico, margine postico tenuiter, macula subalari, post-scutello, maculis 2 metanoti summi abdominisque segmentorum 1ⁱ, 2ⁱ limbo, albidis; alis subhyalinis antice subferrugineis, apice griseis.

♂. Clypeo subemarginato, luteo.—♀?

Odyn. Gayi SPINOLA, in Gay's Hist. fis. de Chile, Zool. VI, 260 (1851).

—SAUSS. Vespides, I, 170, 59; pl. xvii, fig. 7, ♂.

Hab. Chili. (Type in the Paris Museum.)

75. *O. præcox* SAUSS.—Niger, capite et thorace confertim punctatis; abdomine sericante, conico, basi lato; macula mandibularum, linea frontis verticali, pronoti margine postico, nec non antico tenuiter, macula subalari, punctis 2 in scutelli angulis, post-scutello, maculis 2 metanoti abdominisque segmentorum 1ⁱ, 2ⁱ margine, flavis; reliquorum margine fusco; tibiis flavo-lineatis; tarsis fusco-ferrugineis; alis subhyalinis, costa obscuriore.

♀. Clypeo apice dentulis duobus rufis.—♂?

Odyn. præcox SAUSS. Et. Vesp. III, 254,¹ 130; pl. xi, fig. 9, ♀, (1854).

Hab. The southern parts of Brazil and Uruguay. (Paris Museum.)

Observation.—This species may possibly belong to the Division *Odynerus* with hooked male antennæ? but its peculiarities bring it nearer to the species of Division *Pachodynerus*.

76. *O. La Platae* SAUSS.—Niger, punctatus; abdomine sericeo, basi truncato; clypeo ♀ apice dentulis 2 ferrugineis terminato, scapo subtus rufo; pronoti margine postico, signatura subalari, punctis 2 tegularum,

¹ The note intercalated in the text of the description of this species referred it to the heading A (Group of the *O. Megera*). One more of the chefs d'œuvre of the printer, who is the cause of all other more grave faults introduced by his negligence into my work on the Vespides.

flavis; abdominis segmentorum 1ⁱ, 2ⁱ margine flavo, 3ⁱ, 4ⁱ tenuiter flavescents; tibiis 1^a, 2^a linea flava; alis ferrugineis macula radiali fusca.

Odyn. La Plata SAUSS. Rev. et Mag. de Zool. XXII, 1870, 52, 2 ♀.

♀. Total length, 12 mm.; wing, 9.5 mm.

♀. Form rather slender, very much as in *O. cubensis* and *tibialis*. Clypeus pyriform, strigate-punctate, terminated by two little ferruginous teeth. Head and thorax densely punctate. Post-scutel truncate, ridged but not crenulate. Metathorax excavated in its whole width, forming on each side an indistinct angle; its superior edges convex, very sharp, their superior extremity hardly separated from the post-scutel by a fissure, not forming salient teeth; the inferior edges straight or a little arched concave. Abdomen polished, silky, the first segment as wide as the 2d, almost sharply truncate.

Black; scape ferruginous beneath; a fine line along the posterior edge of prothorax and a very slender one along the anterior margin, on each side, two spots on the tegulæ, a mark under the wing, a line on post-scutel, and the superior edges of metathorax, yellow. Segments 1, 2 of the abdomen narrowly margined with yellow; the extreme margin of the 1st brown; segments 3-5 narrowly margined with brown or yellowish. Knees and claws ferruginous. Tibiæ 1st and 2d anteriorly with an indistinct yellow line. Wings ferruginous along the anterior margin; the radial cell brown.

Res. a. diff.—This is possibly the same as *O. præcox*, and I should not have distinguished this from it, if in the description of *præcox* it was not said that the metathorax was rounded, while here the superior edges are very sharp.—It much resembles *tibialis*, but the livery is rather different and it varies also in its metathorax not sharply bidentate, its abdomen not as conical, its first segment not as sharply truncate, shorter, etc.—From *zonatus* it differs in its livery and the same changes in the form of the prothorax.

Hab. The Argentine Republic. Buenos Ayres.

77. *O. tibialis* SAUSS.—Niger, cinereo-hirtus; dense punctatus; thorace quadrato, ♀ longiore quam latiore, ♂ cubico, depresso; metanoto bidentato, acutissime marginato; abdomine valde conico basi acute truncato et canthum acutum transversum efficiente; segmentorum 2-5 margine punctato. Macula mandibularum, pronoti margine, tegulis,

macula subalari, post-scutello, metanoti maculis 2 superne abdominisque segmentorum limbo 1, 2 flavis; tibiis extus flavis; alis ferrugineis, apice nubecula fusca.—Longit, 11 mm.; alæ, 9 mm.

♀. Clypeo piriformi, grosse punctato, apice subbidentato superne flavo.

♂. Clypeo ovato, flavo, apice submarginato; antennarum scapo flavo fasciato; flagello apice haud uncinato.

Odyn. tibialis SAUSS. Et. Vesp. I, 183, 78 (1852), ♀

Ress. a. diff.—This has the form of *O. cubensis*, from which it differs by its black forehead, antennæ, scutellum, and feet; by its thorax not so strongly punctured, by the edges of metathorax not so much separated from the post-scutellum, and by the clypeus ♀ more coarsely punctured and not distinctly bidentate, while the male has the apical margin of the clypeus a little concave, with acute angles.

Hab. Venezuela. Caraccas ♀. (Hayti ♂.)

Observation.—The ♀ comes from the collection of De Romand, whose etiquettes are not always exact. The male is labelled as caught by me at Hayti. This male is certainly of the same species as the female. The species may come from St. Domingo.

78. *O. Cubensis* SAUSS.—Niger; capite et thorace dense cribri instar punctatis; pronoto antice subcoarctato; post-scutello truncato, transversum tenuiter carinato; metanoto verticali, excavato, utriusque dente instructo, superne canthis acutissimis marginato, his a post-scutello fissura sejunctis; abdomine conico; primo segmento antice acute truncato canthum transversum efficiente; secundi segmenti margine punctato. Mandibulis, macula frontali, antennarum articulis 1°, 2°, pronoti margine antico late, tegulis, macula subalari, scutelli maculis 2, post-scutello, metanoto summo utrinque, abdominis segmentorum 1–2 margine (primi fascia in lateribus aucta), et pedibus, flavis; abdominis segmentis 4–6 rufis, et frequenter tertio rufo-limbato; alis ferrugineis, apice fusco-nebulosis.—Longit, 11 mm.; alæ, 9.5 mm.

♀. Thorace longiore quam latiore; clypeo piriformi, punctato, flavo, macula nigra, apice bidentato dentibus angulatis.

♂. Thorace magis cubico; clypeo ovato, flavo, lævi, apice truncato, biangulato; oculorum sinu flavo-marginato. Antennis apice simplicibus.

Odyn. cubensis SAUSS. Et. Vesp. I, 181, 75,¹ pl. xviii, fig. 8 (1852).

Hab. Cuba. (2 ♀, 2 ♂.)

¹ In this description I have mingled the form of the clypeus ♀ with the description of the ♂, doubtless because the simple antennæ of the ♂ led me to take a ♂ for a ♀.

79. *O. Californicus* SAUSS. (Pl. III. fig. 17, 17a)—Medius, niger, fulvo-tomentosus; clypeo ♀ piriformi valde punctato; thorace lævi, tenuiter punctato; metanoto haud rugoso, biangulato, sed canthis obliteratis, nec acutis, nec rugosis; abdomine conico, segmentis 2^o et sequentibus in margine rugose punctatis; fascia arcuata summi clypei, pronoti et abdominis segmentorum 1ⁱ, 2ⁱ limbo, macula subalari, punctis 2 in tegulis, post-scutello et metanoti canthis, luteis; antennis fronte et pedibus immaculatis; alis diaphanis, venis fuscis. ♀.

Odyn. Californicus, SAUSS. Rev. et Mag. de Zool. XXII, 1870, 57, 9, ♀.

Total length, 11 mm.; wing, 9 mm.

♀. Size and form of the *O. foraminatus*, clypeus pyriform, strongly punctured, terminated by a little border channelled by a fossette and appearing bidentate. Head finely punctured. Thorax not retracted before, its surface smooth, shining, bearing some quite fine, separated punctures (at times effaced, especially in the middle of the mesothorax and of the scutel); post-scutel a little pad-shaped, finely crenulate (or smooth); metathorax not rugose above; its concavity wide, smooth, and shining, finely striate; it occupies the whole width, but its ridges are rounded, or at least blunted, not salient on the summit (although delicately formed), but smooth, not rugose, nor cribose; on each side an angle, blunt or even rounded, according to individual specimens. Abdomen quite conic; the first segment truncate, but without sharp ridge; the second offering along its border a flat impressed band, carrying a narrow band of very coarse punctures, but the extreme border smooth. The following segments strongly punctured.

Insect black, clothed on the head and thorax with a strong pile of tawny or grayish hair; its hair very abundant on the metathorax. A spot on the mandibles, an arcuate band (or two spots) on the summit of the clypeus, a regular border on the prothorax, a spot under the wing, post-scutel, ridges of the metathorax, and a border on the first two segments of the abdomen (the first widened on its sides), of a pale yellow; antennæ and legs entirely black; the tarsi ferruginous toward the end only. Wings transparent, a little smoky; nervures brown. Wing scales having two yellow spots; their middle occupied by a brown spot.

Var. a. Two yellow spots on the extremity of the clypeus.

b. Inner border of the orbits, a spot on the front, a dot behind each eye, two dots on the angles of the scutel, a spot on the

knees, whitish; anterior tibiæ ferruginous or whitish; 3d and 4th segments of the abdomen bordered with whitish beneath; 3d finely edged above with this color.

Ress. a. diff.—This *Odynerus* resembles the *O. Megæra* in its whitish ornaments, but it is smaller. Its smooth thorax, its mesothorax without longitudinal grooves, its metathorax, smooth, biangulate and without little teeth behind the post-scutel, its immaculate front, and its transparent wings distinguish it superabundantly.

The same characters distinguish it from the *O. foraminatus* and the *O. leucomelas*.

Hab. Lower California. I have received divers specimens ♀ collected at Cape St. Lucas by Mr. John Xanthus and others from Southern California (Berton).

Observations.—This species has much of the form of the *O. cubensis*, but the male being unknown to me I place it with hesitation in this division. If the male proves to have antennæ terminated by a hook, the species will find its place in the Division *Odynerus*, next the *O. Alvaradi*. With the *O. Erinnys* it is the only *Pachodynerus* yet known to inhabit the boreal temperate zone.

2D. SECTION.—*Form more lengthened; thorax lengthened square or retracted behind. Abdomen less conic, more cylindrical or depressed.*

a. All the segments of the abdomen, except the first, bordered with yellow.

80. *O. diabolicus* SAUSS.—Gracilis; capite et thorace dense rugose punctatis; pronoti margine antico concavo, suberistato, angulis subacutis; post-scutello truncato, transverse cristato-crenulato, metanoto excavato, utrinque bispinoso, marginibus excavationis acutis verticalibus, superne evanescentibus; abdomine subdepresso, antice rotundato-truncato; segmento satis elongato. Omnino niger, abdominis segmentis 2-6 flavo-ochraceo limbatis; tarsis apice fusciscentibus; alis nebulosis.

♀. Clypeo bicarinato, apice bidentato, vel acute biangulato.

♂. Clypeo polygonali, apice truncato, luteo-argenteo; labro, antennarum scapo subtus, macula frontali, fascia in sinu oculari, luteis.

♀. Total length, 12 mm.; wing, 9.5 mm.

♂. Total length, 11 mm.; wing, 7.5 mm.

Odyn. diabolicus SAUSS. Vespides, I, 171, 60 (1852); III, 230.—Rev. et Mag. de Zool. X, 1858, 167, 6.

A very distinct species in the form of its metathorax. The lateral tooth of metathorax is formed principally by the *lateral ridge*, and placed quite outside of the margin of the excavation, which is situated more inside, and rather distant from the tooth. There is, in addition, a very long spine on each side, on the inferior edges near the articulation of the abdomen. It has much the appearance of *O. argentinus*, but the metathorax is without lateral angles.

Hab. South America; Brazil, Venezuela (author's collect.).

b. Abdomen varied with black and rufous.

81. *O. Erinnyx* LEPEL.—Niger, valde punctatus, gracilis; thorace postice attenuato; metanoto longe bispinoso, canthis acutissimis marginato; abdomine basi truncato; in marginibus valde punctato; ore, macula frontali et antennarum articulis 1-5 rufis; pronoto, tegulis, post-scutello, metanoti angulis, abdominis primo segmento superne et secundi margine pedibusque, rufis; alis infuscatis, costa subferruginea.

♀. Clypeo piriformi, crasse punctato, bicarinato, apice biangulato, apice et basi, rufis.

♂. Clypeo polygonali, luteo, argenteo-sericeo, subbidentato; antennis apice haud uncinatis.

Variat. Primo et secundo abd. segmentis flavo-marginatis.

Odyn. Erinnyx LEP. ST. FARGEAU, Hymén. II, 645, 30 ♀ (1841).—SAUSS. Vespides, I, 178, 70.

Total length, 16 mm.; wing, 11 mm.

♀. Form slender, moderately lengthened. Head and thorax coarsely cribose; this last quite lengthened, retracted behind; post-scutel finely crenulate; metathorax having its posterior face a little retracted; strongly excavated, a little oblique, smooth, finely striate; bordered with *abrupt very trenchant* ridges, which are armed on each side with a long spiniform tooth, prism-shaped, and prolonged obliquely backward; it is placed sufficiently low for the inferior ridges of the metathorax to be almost horizontal; these last offer beyond on each side of the valves of articulation with the abdomen, a second distinct spine. The superior ridges are sinuous and terminate under the post-scutel by an arc or nearly a right angle; seen in profile their summit terminates in a pyramidal, although but little acute, angle, placed quite behind the post-scutel and separated from it by a triangular notch.

Abdomen of little width; finely punctured, the first segment long, almost as wide as the 2d, and boldly truncate on its anterior face; the 2d cylindrical; its posterior border and the following segments strongly punctured.

Insect black, clothed with a short grayish pile. Mouth, extremity and summit of the clypeus, a spot on the front, articles 1-5 of the antennæ, red. Prothorax, wing scales, superior angles of the clypeus and legs, equally red. First abdominal segment above, wholly of a sombre-red; the second bordered with red; the border of 3d and often the anus slightly ferruginous. Wings brownish, with violet reflections; the side a little ferruginous.

Var. The 1st segment adorned with an orange border; the border of 2d passing also into orange.

♀. Clypeus pyriform, very coarsely cribose, bicarinate toward the base, prolonged and strongly truncate at the extremity; its little border biangulate but straight.

♂. Clypeus polygonal, a little longer than wide; pale yellow, covered with silvery hair; its anterior border subconcave, sub-bidentate. Antennæ simple, terminated by a very small sharp nipple. Inner border of the orbits yellow or ferruginous; the frontal spot yellow. Ridges of the metathorax still more trenchant, terminated superiorly by a more acute angle of a pyramidal form.

Var. Clypeus orange.

Res. a. diff.—This species, although similar in colors with *O. Boscii* and *O. arvensis*, differs essentially from them by its lengthened thorax, strongly retracted behind, by its little metathorax, by its long metathoracic spines, its much more trenchant and elevated ridges, its slender form, its clypeus longer than wide, and the simple antennæ of the males.

The form of the abdomen slightly recalls that of the *O. 4-sectus*; the livery that of *O. dorsalis*, variety.

Hab. The Southern United States. Carolina. Florida. 3 ♀ 1 ♂ from Florida (E. Norton).

Division ODYNERUS.

SAUSS., III^d divis., Sect. II^d (Bt. Vesp. I, 177); Divis. *Epsilon*,
Sect. II^d (ibid. III, 254).

Forms as in Division PACHODYNERUS, but often more elongate; the thorax more cubical, always in shape of an elongate-square, often rather narrowed behind. Abdomen conical as in PACHODYNERUS, or ovate-conical, BUT THE FIRST SEGMENT ALWAYS FULLY INCLUDING THE BASE OF THE 2D. (By exception, irregularly contracted at base of the 2d segment, the first segment being smaller, rather cup-shaped.—O. MORELII.)—Antennæ of the males terminated by a hook.

The Odyneri of this Division have forms quite approximating to those of Division *Pachodynerus*, forms which have been described above, and they differ from these principally in the antennæ of the males which have the 13th joint recurved into a little hook.

As these forms are not exactly alike in all, we arrange the species in a series in which we can follow the thorax as it becomes more elongate, and rather contracted behind, with the metathorax becoming more and more rounded, losing its sharp edges, while the abdomen is less conical and more and more ovate-conical.

This Division includes quite varied types, principally characterized by the modifications of the metathorax (which is sharp, spined or rounded, and blunt), and by the form of the abdomen, quite conical or elongate and more ovate. The more elongate species pass into the forms of the Division *Stenodynerus*. As these distinctions are difficult to establish, I have prepared a tabular statement of them.

Table to assist in distinguishing the Division ODYNERUS and STENODYNERUS, with regard to PACHODYNERUS.

{	Post-scutel truncate; abdomen conical.	{ <i>Pachodynerus</i> .
		{ <i>Odynerus</i> .
{	Post-scutel truncate; abdomen spindle-shaped, the first segment rather subpetiolate or funnel-shaped.	<i>Stenodynerus</i> .
	Post-scutel not truncate; oblique, posteriorly angulate, punctate.	<i>Stenodynerus</i> .
{	Thorax cubical.	<i>Pachodynerus</i> .
		{ <i>Pachodynerus</i> .
{	Thorax more lengthened.	{ <i>Odynerus</i> .
		{ <i>Stenodynerus</i> .

{	Superior face of metathorax produced behind the post-scutel.	<i>Stenodynerus.</i>
	Superior face of metathorax not produced behind the post-scutel.	
{	a. Truncate, with the post-scutel.	<i>Pachodynerus.</i>
	b. Truncate, without the post-scutel, which is not truncate.	<i>Odynerus.</i>
{	Abdomen elongate, its base widely truncate.	<i>Stenodynerus.</i>
	Abdomen conical.	<i>Odynerus.</i>
{	Abdomen spindle-shaped, contracted at base, the first segment funnel-shaped or cup-shaped.	<i>Stenodynerus.</i>
	First abdominal segment longer or as long as wide.	<i>Pachodynerus.</i>
{	First abd. segment having its superior face wider than long.	<i>Odynerus.</i>
		<i>Stenodynerus</i> (by exception).
{	First abd. segment more strongly punctured than the second.	<i>Stenodynerus.</i>
	First abd. segment not so strongly punctured as the second; smooth.	<i>Pachodynerus.</i>
{	First and second segments equally punctured.	<i>Odynerus.</i>
		<i>Stenodynerus.</i> } exceptionally.

The insects of this group have a marked tendency to become rugose, and the border of the 2d abdominal segment is cribose with strong punctures; in general, at any rate, it offers a zone, rugose and a little impressed or channelled.

But there is a set of species which offers, on the contrary, a smooth, shining body, with a tendency to omit the punctures. This type is represented here by the *O. bidens* only, but is met again in other genera.

The species presenting a rugose body offer a great similarity to the European species, and this similarity goes so far that one might attempt to indicate with certainty among them the European type from which they seem to be derived. So, for example, the *O. (Rhynchium) dorsale*, derived from the *Rhynchium oculatum*; the *O. foraminatus* from the *O. simplex*, etc., while those having a smooth body which have been identified, are of a type

exclusively American. The *O. bidens* in particular, with its great size, its black-violet wings, its white ornaments, forming large spots, its smooth body, is a type of which the form has no similarity either in Europe or elsewhere, while it recalls other species peculiar to North America (*Monobia uncinata*, *Ancistrocerus 4-sectus*).

The species which form the Division *Odynerus* occupy in America principally the northern temperate zone. They appear to be yet more numerous in North America than in Europe.

Table to assist the determination of the species of Division Odynerus.

Nota.—Compare *O. Crypticus* (No. 95), which could not be introduced into this table, not being sufficiently well known; and at the end of the genus, the list of *species incertæ sedis*.

1. Second abdominal segment having a particular form.
2. Second abdominal segment deformed.
 3. Swollen posteriorly, forming two gibbosities, its margin very deeply canaliculate and much reflexed. 110. *cluniculus*.
 - 3, 3. Without strong gibbosities; the margin only strongly canaliculate. 111. *Morelii*.
- 2, 2. Second abd. segment produced in the middle, forming a sharp angle or tooth. *productus*.¹
- 1, 1. Second abd. segment not deformed, normal, not swollen.
 2. Wings black or fuscous, with violet iridescence.
 3. Ornaments of the body white or luteous.
 4. Metathorax black, 2d segment margined with luteous. 101. *Megera*.
 - 4, 4. Metathorax maculate with luteous; 2d segment not margined with luteous. 90. *bidens*.
 - 3, 3. Ornaments of the body yellow or rufous.
 4. Metathorax angulate.
 5. First abd. segment sharply truncate at base. 82. *Hidalgii*, var.
 - 5, 5. First abd. segment not so sharply truncate, more rounded. 84. *dorsalis*.²
93. *annectens*.
 - 4, 4. Metathorax rounded; insect velutinous. 109. *Romandinus*.
- 2, 2. Wings subhyaline or clouded or ferruginous.
3. Body much adorned with rufous; prothorax often rufous.
4. Metathorax not forming on each side a lateral dentiform angle.

¹ Compare at the end of Genus *Odynerus*, the *species incertæ sedis*.

² Compare also *O. Boscii* and *arvensis*, sometimes with rather obscure wings.

5. Insect black and dull rufous, with yellowish ornaments; body velutinous, hairy.
6. Second abd. segment not canaliculate. 108. *Guerreri*.
- 6, 6. Second abd. segment having its margin strongly canaliculate. 111. *Morelii*.
- 5, 5. Insect ferruginous and black, with bright yellow ornaments; abdomen polished, not velutinous. 94. { *annulatus*.
106. { *pratensis*.
- 4, 4. Metathorax forming on each side a dentiform angle.
5. Size very large.
6. Wings smoky. 84. *dorsalis*.
- 6, 6. Wings ferruginous. 85. { *proctus*.
86. { *consors*.
- 5, 5. Size medium or small.
6. Superior angles of prothorax not prominent. 99. { *apicalis*.
94. { *annulatus*.
92. { *urvensis*.
- 7, 7. Wings ferruginous.
8. Second abd. segment not canaliculate.
9. Size smaller. 98. *spectabilis*.
- 9, 9. Size larger. 94. { *annulatus*.
99. { *apicalis*.
- 8, 8. Second segment more or less canaliculate.
9. Post-scutel crenulate; abdomen conical. 89. *Iturbidi*.
- 9, 9. Post-scutel not crenulate; abd. not conical. 111. *Morelii*.
- 6, 6. Superior angles of metathorax prominent, separated from post-scutel by a fissure or a notch. Size medium.
7. Margins of segments 2d, 3d, reflexed; post-scutel yellow.
8. All the segments margined with yellow. 82. *Hidalgi, var.*
- 8, 8. Segments 1-3 margined with yellow. 82. *Hidalgi, var.*
- 7, 7. Margins of segments 2, 3 depressed, but not reflexed; post-scutel black. 83. *Boscii*.
- 3, 3. Body black, adorned with yellow or luteous.
4. Ornaments luteous.
5. All the abd. segments margined with luteous. 103. *leucomelas*.
- 5, 5. Only 2d segment margined with luteous. 101. *Megara*.
- 4, 4. Ornaments yellow.
5. Post-scutel black.
6. Segments 1, 2 margined with yellow; wings cloudy, brownish. 83. *Boscii*.
- 6, 6. Segments all margined with yellow; wings ferruginous. 91. *Alvaradi*.
- 5, 5. Post-scutel adorned with yellow.

- 6. Very large species. 85. { *proctus*.
- 86. { *consors*.
- 6, 6. Species of medium or small size.
- 7. Metathorax forming on each side a lateral angle.
- 8. Superior angles of metathorax separated from post-scutel by a fissure or a notch.
- Superior angles produced into erect spines; scutel yellow. 87. *scutellaris*.
- 9, 9. Superior angles not spined.
- 10. Lateral angles acute; margin of 2d segment reflexed; scutel black. 82. *Hidalyi*.
- 10, 10. Lateral angles obsolete; margin of 2d segment not reflexed; scutel maculate.
- 11. Metathorax very sharp; 1st segment broadly margined with yellow. 100. *turpis*.
- 11, 11. Metathorax not sharp; 1st segment not margined in the middle. 86. *Cordova*.
- 8, 8. Superior angles of metathorax not produced.
- 9. Scutel yellow or maculate; clypeus ♀ yellow; wings ferruginous.
- 10. Second segment margined with yellow.
- 11. Smaller; more slender; scutel yellow.
- 98. *spectabilis*.
- 11, 11. Larger, less slender, scutel maculate.
- 91. { *apicalis*.
- 97. { *formosus*.
- 10, 10. Second segment mostly yellow.
- 96. *sulfureus*.
- 9, 9. Scutel black; clypeus ♀ rufous or black and yellow.
- 10. Ornaments of the body bright yellow.
- 11. Wings smoky. 92. *arvensis*.
- 11, 11. Wings smoky-ferruginous. 94. *annulatus*.
- 10, 10. Ornaments dull yellow; wings ferruginous; body rather pubescent. 91. *Alvaradi*.
- 7, 7. Posterior face of metathorax more or less orbicular, not forming two lateral angles.
- 8. Superior edges of metathorax sharp, produced, separated from post-scutel by a distinct fissure or a notch.
- 9. Segments 1, 2 margined with luteous.
- 101. *Megara*.
- 9, 9. Segments 2, 5 margined with yellow or luteous.
- 10. Second segment without yellow maculae.
- 11. First segment only maculate on the sides.
- 88. *Cordova*.
- 11, 11. First segment margined with yellow.
- 12. Scutel maculate with yellow.
- 13. Edges of the concavity of metathorax very sharp. 100. *turpis*.

- 13, 13. Edges of the concavity of metathorax more blunted. 105. *molestus*.
 12, 12. Scutel black.
 13. Fascia of the first abd. segment narrow; ornaments pale. 103. *leucomelas*.
 13, 13. Fascia of the first abd. segment wider; yellow. 102. { *foraminatus*.
 107. { *flavopictus*.
 10, 10. Second segment with lateral yellow maculae or fascia. 104. *blandus*.
 8, 8. Superior angles of metathorax not produced behind the post-scutel or scarcely produced.
 9. Second segment without lateral yellow spots.
 10. Metathorax strongly excavated, rough; all the segments margined with yellow. 105. *molestus*.
 10, 10. Metathorax not strongly excavated, not rough; 2, 3 segments margined with yellow. 109. *Romandinus*.
 9, 9. Second segment with lateral yellow spots or fasciae. 104. *blandus*.

Description of the species.

SECTION I.—*Post-scutel sharply truncate; its transverse edge often crenulate. Abdomen conical or ovate-conical; the second segment not strangulated at base; the first segment including it very naturally.*

1. *Posterior plate of metathorax angulate, forming on each side a lateral dentiform angle. (Thorax square, angulate, posteriorly wide, not contracted. Abdomen very conical.)*
 A. *Concavity of the metathorax polygonal, margined with straight or arcuate ridges, which form at their meeting a sharp angle. The superior lateral edges superiorly terminating in a tooth or eminence, separated from the post-scutel by a deep fissure, or by a notch.*

These teeth are more distinct in the males than in the females, sometimes obsolete in the females.¹ Comp. Sec. B.

a. *Ridges of the metathorax very salient; its posterior face excavated.*

* *Posterior margin of 2d and 3d abdominal segments reflexed.*

82. **O. Hidalgo** SAFFRS.—Niger, crasse cribri instar punctatus; clypeo in utroque sexu truncato; metanoto valde concavo, biangulato, canthis

¹ Principally in *Odyn. Boscii* and *dorsalis*.

maxime acutis marginato; abdomine conico, basi acute truncato; segmentorum 2¹-4¹ margine grosse punctato; 2¹ et 3¹¹ reflexo; scapo subtus, macula frontali, oculari, post-oculari, pronoti margine antico, post-scutello, tegulis, macula subalari et utrinque metanoti summi, abdominis segmentorum 1¹-3¹¹ marginibus, flavis; primi fascia utrinque aucta; pedibus et mandibulis ferrugineo- et flavo-variis; alis infuscatis violascentibus. ♀. Clypeo nigro, flavo-binotato; ♂ clypeo flavo.

Variet signaturis plus minusve fulvis (Am. borealis).

Varietas Mexicana.—Nigro et rufo-variegatus, vertice nigro; antennarum articulis 10, 20 ferrugineis; pronoto, macula subalari, tegulis, scutellis, metanoti lateribus, rufis vel flavo-variis; abdomine rufo; segmentorum limbo flavo-vario; 1¹, 2¹ basi nigro-angulato, pedibus rufis.—♂. Clypeo, capitis signaturis et scapi fascia, flavis; pronoti limbo, scutellis, macula subalari et tibiis aurantiacis.

♀. Total length, 13-14 mm.; wing, 10-11 mm.

♂. Total length, 11 mm.; wing, 8 mm.

Odgn. Hidalgo SAUSS. Rev. et Mag. de Zool. IX, 1857, 275 (var).

Appearance of a *Rhynchium*, but the mouth quite as in *Odynerus*; the joints of the maxillary palpi becoming regularly shorter from the first to the last.

Clypeus punctured, widely truncate, its inferior part rather flattened and laterally bicarinate. Thorax in the form of an elongate square, not contracted posteriorly, densely and coarsely punctured. Post-scutel sharply truncate, strongly crenulate. Metathorax very rough on its superior and lateral face; its posterior concavity occupying its whole width, shining, strigose, margined with very sharp edges, which form on each side a very strong dentiform angle, and which terminates superiorly in two eminences separated from the post-scutel by two deep fissures. Abdomen silky, quite conical, not ovate; its first segment large, as wide as the second, sharply truncate anteriorly; the margin of 2d and following segments quite coarsely cribose; the border of the 2d and 3d reflexed but not channelled. Mandibles, a frontal mark, inner orbits, post-ocular fascia, scape of the antennæ beneath, anterior margin of prothorax, a spot beneath the wing, tegulæ, post-scutel, a mark on each superior angle of metathorax, yellow or rather fulvous; segments 1-3 margined with yellow, the fascia of the first much widened on the sides or fused with an oblique fascia, often rufous. Legs ferruginous, black at base; tibiæ with a yellow line, or entirely yellow. Wings infuscated,

brown with violet iridescence, or fusco-violaceous; the base paler or a little ferruginous.

Var. Prothorax often with some rufous color; the yellow changing to fulvous.

♂. A little smaller. Maculæ of metathorax larger; its superior ridges very salient, more arcuate, terminated superiorly by a sharp tooth. Mandibles and clypeus yellow; this last polygonal, wider than long; the angles of its inferior wide margin somewhat toothed, the inferior part not prolonged as in *O. arvensis*.

Mexican variety ♀.—Insect rufous and black. Head black; mandibles, clypeus, margins of the orbits complete or interrupted at the vertex, a spot on the forehead, and at base of antennæ, rufous; prothorax, tegulæ, a spot beneath them, rufous; scutellum rufous, notched, with black at base; their margins all yellow; the margin of the first segment widened on the sides. Anus yellow. Feet rufous, varied with yellow. Wings smoky, mixed with ferruginous (*O. Hidalgoi* Sss., l. c.).

Var. Clypeus, scape of the antennæ, and forehead, etc., varied with yellow.

♂. Mandibles, orbits, a triangle on the forehead, a line on the scape of the antennæ, yellow; flagellum often ferruginous beneath; the hook ferruginous. Margin of prothorax, scutellum, a spot under the wing, and tibiæ, often yellow.

Revs. a diff.—This species is peculiar in having its first segment sharply truncate in a right or even more acute angle. It differs from the *O. Boscii* and *arvensis* in its reflexed 2d and 3d abdominal segments, its more sharply truncate 1st segment; in its more elevated metathoracic post-scutellar eminences, its more truncate clypeus.

The type (northern variety) differs from *O. Boscii* in its yellow post-scutellum and black scutellum.

The Mexican (rufous variety) recalls *O. Guerreri* and *Iturbidi*. It differs from the first in its form and its not bidentate post-scutellum; from the second in its metathorax, superiorly very sharp, in the reflexed margin of the 3d segment, the abdomen being sharply truncate at base, not rounded, etc.

Hab. United States. New York. Louisiana (E. Norton).—The temperate part of Mexico. I caught 2 ♀, 1 ♂, var., in the hot part of the province of Mexico, near Cuautla and Cuernavaca. Tamaulipas 1 ♀.

** Posterior margin of 2d and 3d abdominal segments not reflexed, but impressed and rough.

83. *O. Boscii* LEPEL.—Medius, rugosus, clypeo late piriformi, dentibus 2 distantibus terminato; *O. arvensi* simillimus at clypeo minus grosse punctato, metanoti canthis superioribus acutissimis, crenatis; niger, rufo et flavo variegatus, sed pronoto sæpius rufo, flavo-marginato, scutello flavo-vel rufo-bimaculato, post-scutello nigro; abdominis segmentis ♀ 10-20, ♂ 10-40 flavo-limbatis; primo quandoque ante marginem rufo.

Odyn. Boscii LEPEL. St. Farg. Hyménop. II, 637, 22 ♂ (1841).—SAUSS.

Vespid. I, 177, 69;¹ pl. xvii, fig. 10, ♂; III, 231, ♀.

Odyn. castigatus SAUSS. Vespid. I, 178, 71 (1852).

Total length, 14 mm.; wing, 11 mm.

♀. Size, form, and puncturing of the *O. arvensis*, or a little less coarsely punctured. Clypeus widely pyriform, punctuate-striate, terminated by two little separated teeth. Post-scutel strongly crenulate. Metathorax laterally bidentate; its spiniform angles situated a little lower than in the species cited; the posterior plate strongly concave, striate throughout and distinctly bordered with very sharp and trenchant ridges, above all between the spiniform angle and the post-scutel; these ridges a little crenulate and terminating superiorly in a sort of tooth or rather a crenulate angle separated from the post-scutel by a notch; their inner face a little rugose, punctured.

Insect densely and rugosely punctured; the metathorax above very rugose. Abdomen conic; the first segment truncate at base, at a right angle, but the transverse edge rounded, not sharp. Border of the 2d abdominal segment depressed, coarsely punctured, but not reflexed; those following strongly punctured. Insect black. Mouth, clypeus, spots behind the eyes, red or orange; an arc or two spots at the summit of the clypeus, one on the front, and inner border of the orbits, orange; articles 1, 2 of the antennæ red or orange, with an obscure line above. Prothorax red; the anterior border orange; tegulæ red, spotted with yellow; spot under the wing orange or red; clypeus black, with somewhat of red and two yellow spots; two orange spots at the summit of the metathorax; segments 1, 2 of the abdomen bordered with yellow; the border of the first widened on the sides; this widen-

¹ In place of Long. = 0.018, read: = 0.012.

ing varied with red or often almost entirely red. Legs yellow or red, with the base of the thighs obscure. Wings of a brown-reddish, slightly darkened, with some violet reflections (Carolina).

Var. a. Edges of metathorax a little blunted by the rugosities.

b. Prothorax black, slightly bordered with red and very slenderly with yellow; ornaments of the head red; borders of the abdomen narrow. Clypeus black, with a yellow band on the summit.

c. Clypeus black, with two yellow spots.

d. Clypeus black, with two red points (New England). The yellow and the red take each other's places and are more or less developed. Base of legs black.

e. Prothorax black, ornamented with yellow, without red.

f. The 3d segment bordered with yellow.

g. Insect distinctly black and yellow, without red. The ornaments of a sharp yellow. Clypeus black, with a yellow arcuate band on the summit; a yellow line on the scape (New York, Tennessee).

h. Spots on the scutellum very small or none.

♂. Clypeus yellow, but little notched; post-scutellum red or yellow; first abdominal segment red, bordered with yellow. Segments 3, 4 adorned with a yellow edging.

Revs. a. diff.—This *Odynerus* differs from the *O. dorsalis* ♀ by its wider clypeus, and by the trenchant and elevated ridges which border the concavity of the metathorax above the spiniform angle, also by its smaller size, etc. From the *O. arvensis* by these same metathoracic ridges, which are more salient and crenulate, which one may perceive especially in profile; by its black post-scutellum and its scutellum spotted with yellow; by its 3d segment, a little less strongly punctured; its final segments not bordered with yellow. Nevertheless these two species are allied.—From the *O. Hidalgoi* by the absence of the reflexed border of segments 2, 3, by the black post-scutellum, the 1st segment not so acutely truncate, etc.

Hab. The United States, at the South. Florida, 1 ♀. South Carolina, 2 ♀. Tennessee, 3 ♀. New York and Connecticut, 3 ♀ (E. Norton).

The specimens coming from the South are especially marked with red; those of the north become black and yellow.

Observation.—Lepel de St. Fargeau has described a male, and I unfortunately possess only females. He was evidently mis-

taken in saying that the post-scutel is slightly crenulate; however, one finds under this description some variations according to specimens.

84. O. dorsalis¹ FABR.—Validus, niger, valde punctatus; clypeo integro, metanoto postice striato, utrinque dente armato, marginibus rugosis, oblitteratis, nullomodo acutis, canthis ♀ nullis, ♂ elevatiusculis; ore, clypeo, antennarum articulis 1-3, maculis post-ocularibus, pronoto, scutello, tegulis, rufis; pronoto medio, post-scutello et abdominis primi segmenti margine, flavis; margine secundi et tertii rugosissime punctatis;—♂ antennis basi, maculaque subalari rufa; abdominis segmentorum margine 2^o, 3^o flavo, secundo reflexo, subcanaliculato; pedibus flavis, basi nigris; alis fusco-cyaneis.

Variat a fusco et ferrugineo-variegato ad omnino ferrugineum; primo segmento flavo-marginato.

Vespa dorsalis FABR. Syst. Ent. 367, 25 (1775). Ent. Syst. 265, 44.—OLIV. En cycl. Meth. VI, 685, 81.

Polistes dorsalis FABR. Syst. Piez., 273, 19.

Rhynchium balteatum SAY, Bost. Journ. I, 1837, 383, 1.—Say's Entom. Lx CONTE, II, 764, 1.

Monobia sylvatica SAUSS. Et. Vesp. III, 168.²

Rhynchium Louisianum SAUSS. Et. Vesp. I, 106, 7; pl. xiii, fig. 9³ (1852).

Rhynchium dorsale SAUSS. Et. Vesp. III, 171.

♀. Total length, 17 mm.; wing, 14 mm.

♂. Total length, 17 mm.; wing, 12 mm.

♀. Large. Clypeus wider than long, but pyriform, terminated by a truncation or even a little rounded; its surface covered with quite fine punctures. Mandibles long, hooked; armed in the middle of their inner border with 3 or 4 oblique teeth, but their final portion simply cutting, not dentate. Head and thorax densely cribrate with strong punctures; prothorax retracted before. Scutel briefly truncate, bearing a crenulate crest, interrupted in the middle. Metathorax very coarsely punctured, very rugose upon its borders; quite variable according to specimens; its hinder plate quite flattened, striate, forming on each side a dentiform angle (at times blunted); its superior borders sometimes quite trenchant, sometimes effaced, scarcely offering tren-

¹ Compare *Rhynchium dorsale*, page 143.

² Compare page 132, No. 3, most likely a different species.

³ On the inscription upon this plate, in place of: 9. *Rh. limbatum*, read: 10. *Rh. limbatum*; and in place of: 10. *Rh. Louisianum*, read: 9. *Rh. Louisianum*.

chant ridges, but rounded and rugose, rarely elevated so as to be separated from the post-scutel by a fissure, so that the post-scutel appears very salient. The concavity striate, its borders rugose. The superior crest salient or effaced. Abdomen wide, conical; the first segment truncate, but rounded, without a ridge; the 2d segment finely punctured, offering along its posterior margin a wide rugose band, a little depressed, garnished with coarse punctures; this band a little widened in the middle, but the little border (the very edge) smooth; following segments strongly punctured, with the extreme margin smooth.

Black Variety.—Insect black; mouth, clypeus, a spot on the front, inner border of the orbits, a great spot behind each eye, articles 1–3 of the antennæ, rufous; prothorax, tegulæ, scutel, equally rufous; in the middle of the prothorax a double spot and on the post-scutel a line or two dots, yellow; first abdominal segment ornamented with a yellow border widened on the sides. Legs black, knees, tibiæ, and tarsi, yellow. Wings of a deep brown violet.

Var. a. Scutellum black.

b. Border of 2d and 3d abdominal segments brown.

c. Border of 2d and 3d segments narrowly yellow.

d. Clypeus black, spotted with ferruginous. Scutel black, with two red spots.

e. Disk of mesothorax with two hooked rufous maculæ.

f. The ferruginous more extended; two ferruginous spots on the mesothorax; scutel and metathorax ferruginous; abdomen ferruginous with the first two segments notched with black at the base and their border yellow (Louisiana) (*Polistes dorsalis* Fabr. *Rh. Louisianum* Sauss.).

g. Almost entirely ferruginous, with the border of the first segment yellow. Legs, mandibles, orbits, varied with orange (Illinois).

h. The two metathoracic teeth blunted, not very distinct.

Rufous Variety.—The whole insect rufo-ferruginous; scape beneath, hinder margin of prothorax, tegulæ, a line on the post-scutel, border of the 1st segment of the abdomen, yellow; feet mostly yellow, and the flagellum only of the antennæ black.—Mexico.

—*a.* A spot on the vertex, anterior part of mesothorax, base of the first two segments of the abdomen black (Tennessee).

—*b.* All the intermediate degrees between the black and the rufous variety (Illinois, Tennessee).

♂. Metathorax less blunted on the latero-superior borders of the concavity, the superior edges more elevated, forming lines of salient rugosity, and separated from the post-scutel on each side by a fissure; often exhibiting two slightly crenulate salients; the two lateral teeth very sharp. Abdomen more conical.

A little smaller; clypeus as long as wide, yellow. Mandibles, inner borders of orbits, spot on the front, and a line on the scape of the antennæ, in general, yellow; hook of the antennæ ferruginous. A red spot under the wing. Borders of abdominal segments 2, 3 adorned with yellow; the 2d reflexed, strongly channelled; rugosities of these two borders excessively strong. Wing not so deeply colored as in female.

Var. a. Angles of metathorax red; a little red bordering the yellow within the black notch of the first segment, especially on the right and the left.

b. Two yellow dots on the superior face of the metathorax and two beneath the wings.

c. The whole anterior border of the prothorax red, widely margined with yellow.

d. Wings transparent. Scutellum black.—Illinois (Walsh).

e. Body more and more rufous.

This species seems to become more rufous as it goes southward. It is also rather variable in the strength of the punctures.

Rees. a. diff.—The *O. dorsalis* is remarkable for the inequality of the metathorax in the different sexes, from whence it results that the males are well placed in this section, while the females seem by their effaced ridges to go better into the Divisions B. or C. The species greatly resembles the *O. Boscii* and *arvensis*, but above all it differs from them by its greater size, by its truncate, not bidentate clypeus, and by its more obscure wings. It differs from the *O. Boscii* by the less elevated ridges of the metathorax, and from the *arvensis* by the more elevated ridges. The ferruginous individuals resemble the *O. Iturbidi*. Finally, the species is clearly different by its maxillary palpi, which are those of a *Rhynchium*.¹

¹ With the *O. dorsalis*, the maxillary palpi have the 1st article large; the 2d and 3d slender and long; the last three quite small. The 8d

Hab. The United States, especially the South. I possess divers individuals taken in Pennsylvania (Rathvon), Illinois (Walsh), Tennessee (Fuchs), Louisiana (Norton), South Carolina (author). I have taken the red variety in Mexico.

Observation.—I am not entirely certain whether my *Monobia silvatica* should be fused into this species or whether it is a true *Monobia*, the label of it being uncertain and the palpi having been found in an imperfect state. The type I cannot examine again.

85. *O. proctus* CRESSON.—Pallide ferrugineus; orbitis, clypeo, margine antico pronoti, scutellis, macula subalari, pedibus partim abdominisque segmentorum 1ⁱ, 2ⁱ, marginibus, obscure-flavidis; antennis mediis nigrescentibus; alis pallide flavescensibus. ♀.

Odyn. Proctus CRESSON, Phila. Ent. Proceed. IV, 1865, 159.

Total length, 8.5 lines; expanse of wing, 15 lines.

♀. Head dull-ferruginous, dusky above the insertion of each antennæ, around the ocelli and on the occiput; inner orbits of the eyes, filling up the deep sinus, a small subcordate mark between the antennæ, the clypeus, and most of the mandibles yellowish; clypeus large, closely punctured, flattened on the disk, and slightly and obtusely emarginate at tip; mandibles black at tip; palpi pale ferruginous; antennæ yellowish-ferruginous, the scape yellowish beneath. Thorax fusco-ferruginous, closely and rather deeply punctured, covered with a very short, fine, dull yellowish, subsericeous pile; broad anterior margin of the prothorax above, continued in a narrow line to the tegulæ, and a large spot on each side of the pleura, yellowish; mesothorax fusco-ferruginous, tinged with blackish on the anterior and posterior margins, the disk, with two distant, very faint, longitudinal, ferruginous lines, confluent behind the middle; scutellum and post-scutellum yellowish, the apical margin of the former blackish, and the yellowish portion divided down the middle by a faint fuscous line; metathorax yellow, the suture between it and the post-scutellum, as well as a large spot on the apical middle, fusco-ferruginous; posterior face rather suddenly depressed, with a small tubercle on each side at the angulation; pleura fuscous

article is not longer than the last two taken together, but yet the species may be placed in the genus *Rhynchium*.—Compare what has been said apropos of the genus *Rhynchium*, page 142.

beneath; tegulæ dull yellowish, with a ferruginous stain on the middle. Abdomen oblong ovate, the basal segment dome-shaped, obtusely rounded at base, without transverse suture at carina, distinctly punctured, the remaining segments indistinctly so; apical margins of all the segments above narrowly yellowish, almost divided on the disk by a narrow line, those of the second and third segment broader and dilated on the extreme sides, especially on the first segment, where there is a rather large triangular mark; the bands on the remaining segments more or less emarginate on each side anteriorly; apical segment with a large, broad, angular, dull yellowish mark on the middle; beneath marked as above, except that the apical segment is immaculate, and the second segment is almost entirely yellowish, with three ferruginous spots arranged transversely near the apical margin.

Legs deep yellowish, the femora above and at base beneath pale yellowish and pale ferruginous. Wings deep yellowish-hyaline, faintly dusky at tips; nervures honey-yellow.

Var. This species certainly varies much into black, rufous and yellow.

Rees. a. diff.—I do not know this species, and I can only copy the good description of it given by E. T. Cresson, so that I can not be perfectly sure it should be placed in this section. It is very distinct by its enormous size, still larger than *O. dorsalis*; being the largest North American Odynerus. It is most likely a *Rhynchium*, as well as *O. dorsalis*. I quite agree with the presumption of Mr. Cresson, that *O. consors* may be its male.

Hab. Cuba.

86. *O. consors* CRESSON.—Niger; puncto frontali, orbitis, clypeo, pronoto antice, tegulis, macula subalari, scutellis, metathorace partim, pedibus, abdominisque segmentorum limbo, flavidis; abdomine fusco, segmentis 1^o et 3^o nigrescentibus; alis ferruginescentibus apice griseis.

Olyn. consors CRESSON, Phila. Ent. Proceed. IV, 1865, 160.

Total length, 7 lin.; expanse of wing, 11 lin

♂. Head black, deeply and closely punctured; the orbits, filling up the sinus in front, a spot between the antennæ, dilated above, clypeus, labrum, and mandibles, except tips, yellow (in one specimen more or less ferruginous); antennæ nearly as long

as the thorax, terminating in a hook, black, tinged with ferruginous at base and tips, scape yellowish beneath. Thorax dull blackish, densely punctured, slightly pubescent; broad anterior margin of prothorax continued in a narrow line to the tegulæ, sometimes interrupted, a large spot beneath the tegulæ, scutellum, except its apical margin, and post-scutellum, yellowish, sometimes tinged with ferruginous; pleura slightly sericeous in certain lights, with an oblique dull yellowish stain on each side beneath; metathorax mostly yellowish, the extreme sides spotted or stained with fuscous, the posterior face deeply and broadly excavated, covered with fine transverse striæ, more or less distinct, and with a large blackish mark, covering the disk and spreading out on each side at base; lateral angles prominent and obtuse; tegulæ yellowish, with a ferruginous spot on the middle. Abdomen shaped and marked as in the preceding species, but the general color fuscous, with the third and sometimes the first segments, except their apical margins, blackish, and the spot on the terminal segment above, scarcely defined.

Legs yellow, the femora tinged with ferruginous above. Wings yellowish-hyaline, more deeply yellowish along the costa; the apex, especially about the marginal cell, dusky; nervures honey-yellow.

Hab. Cuba.

This is most probably the male of *O. proctus*, as E. T. Cresson supposes. But not having the insects before my eyes, I cannot safely decide it, nor make one description answer for both.

b. The hinder face of metathorax more flattened; its superior edges not so salient.

* *The superior ridges forming two elevated spines behind the post-scutel.*

87. *O. scutellaris* SAUSS.—Niger, thorace valde punctato, postice attenuato; post-scutello acute truncato; metanoti facie postica planata, valde angulata, utrinque dentata, canthis rectis marginata, supra pone post-scutellum bispinosa; abdomine gracili, punctato; primo segmento basi truncato; segmentis sequentibus margine fortius punctato; macula frontali, post-oculari, pronoti margine, tegulis, macula subalari, scutelli margine, post-scutello, metanoti dentalis, abdominisque segmentorum 1-4 margine pedibusque, flavis; alis fusco-ferrugineis, nebulosis.

♂. Clypeo ovato-elongato, flavo, apice breviter bidentato.

Odyn. scutellaris SAUSS. Rev. et Mag. de Zool. XXII, 1870, 58, 11, ♂.

Total length, 11 mm.; wing, 8 mm.

♂. Form quite slender, a little depressed as with the *Ancistrocerus tigris*. Thorax slightly prolonged, wide before, retracted behind. Post-scutel very freely truncate, offering a *very sharp*, finely crenulate ridge. Metathorax vertical; its truncation quite flat, wide, occupying all its width, forming a plate of a very angulate shape, as with the *Ancistrocerus*, notched at the summit by the post-scutel (in the form of a double pentagon or a double trapezium); this plate, surrounded by small, *straight*, little salient ridges, which at their meeting form very sharp angles, forming thus on each side an angle armed with a tooth; their *superior* angles forming two teeth, wholly spiniform, directed vertically and placed behind the angles of the post-scutel. Abdomen slender; the first segment quite long and as wide as the 2d, distinctly truncate at its base and offering on *its anterior face* a trace of a suture. Head and thorax rugosely, abdomen finely punctured; the border of 2d segment more strongly punctured, offering, however, but one depressed band, only becoming thinner as far as the end. Following segment rather strongly punctured.

Insect black, clothed with a tawny or grayish pile; a dot on the front, another behind each eye, anterior border of prothorax, tegulae, a spot beneath the wing, posterior border of the scutel, post-scutel, and the four little spiniform teeth of the metathorax, orange; segments 1-4 of the abdomen bordered with orange; bordering of the first wide and notched; that of 2d wide and regular; that of 3d and 4th narrow, often shortened at the sides. Legs yellow, black at base. Wings washed with ferruginous.

♂. Clypeus ovoid, notably wider than long, a little notched and bidentate, yellow. Mandibles spotted with yellow. On each side of the frontal spot a place of golden hair. Antennae long and thick, black, with a terminal ferruginous hook; scape very short, yellow beneath. Fifth segment ornamented with a yellow incomplete border. Legs yellow; thighs varied with brown.

♀. Unknown.

Res. a. diff.—This species described simply from one male, is necessarily incompletely characterized, but it is very easy to recognize, from the form of the metathorax, of which the polygonal and flattened plate recalls those of the true *Ancistrocerus*, but with this difference, that it is still more angular, the latero-superior ridges not being arcuate. Despite the vestige of a suture of the first segment, this *Odynerus* incontestably appertains

to the true *Odynerus*, considering the form of the lateral angles of the metathorax and the presence of the post-scutellar teeth. It resembles them more in the strongly punctured border of the 2d and following segments.

This species has the thorax built up upon another system from the *O. Boscii* and its neighbors; it is less excavated; the superior ridges are more convergent and the teeth which terminate them at the summit are spiniform and almost applied to the post-scutel.

Compare with the *O. spinifer*, which presents similar characters (*Divis. Stenodynerus*).

Hab. California (Berton).

** The superior edges of metathorax very slight, only forming behind the post-scutel two very small teeth.

88. *O. Cordovæ* SAUSS.—Niger, sericeus; capite et thorace rugose punctatis; post-scutello crenulato; metanoto utrinque obtuse subangulato, foveola subplanata, superne acutiuscule marginata; abdomine ovato-conico, segmentorum 2-5 margine crassiuscule punctato; clypeo summo, scapo subtus, capitis et pleurarum maculis, pronoti marginibus, tegulis, punctis 2 scutelli; post-scutello, metanoti angulis, abdominis segmentorum 2-5 margine, primi utrinque macula, ano, tibiis tarsisque, flavis; alis subferrugineis apice griseis. ♀.

Odyn. Cordovæ SAUSS. *Revue et Mag. de Zool.* XXII, 1870, 58 10, ♀.

Total length, 10 mm.; wing, 8 mm.

♀. Head and thorax densely and roughly punctate. Forehead a little sulcate. Prothorax having its anterior margin convex, reflexed, subangulate; post-scutel crenulate. Metathorax very coarsely punctured above, rather flattened behind; its convexity not deep, strigose, not margined, except superiorly, where there exists a little oblique ridge, produced by the rugosities, forming a little tooth behind the post-scutel; this is separated from the post-scutel by a sort of fissure. Lateral angles of metathorax distinct, but blunt. Abdomen ovate-conical, truncate at base, smooth and sericeous. Second segment very finely punctured; its margin and the following segments strongly punctured.

Black; mandibles rufous; scape beneath, frontal, ocular, and post-ocular macula, yellow. Anterior and posterior margins of prothorax, a spot under the wing, tegulæ, two spots on the scutel, post-scutel, and angles of metathorax yellow; segments 2-5 of the abdomen regularly and rather widely margined with yellow;

the first having on each side a lateral emarginate yellow spot. Anus, knees, tibiæ, and tarsi, and a spot on the intermediato coxæ, yellow. The yellow ornaments rather orange-yellow. Wings ferruginous at the base, smoky at the extremity.

Var. ? The first abdominal segment narrowly margined.

♀. Clypeus broad, a little bidentate at tip, strigate punctate, black, with a yellow arc on the summit, and two rufous lines over the teeth.

Res. a. diff.—Resembles *O. nasidens*, *diabolicus*, *argentinus*, and neighbors, but the abdomen is not so conical, the first segment not so broad, the body not velutinous as in the first, the metathorax not spined as in *diabolicus*, the thorax not so square, short, and wide as in *argentinus*, the head concave behind, the prothorax rather convex anteriorly. It has also something of the hook of *O. La Platæ*, but the metathorax is not so margined superiorly by arched ridges. In its livery it differs from all of these. This recalls more *O. zonatus*, which differs from it in the same characters as *O. La Platæ*, etc.—Comp. *O. formosus*.

Hab. Mexico. The Cordillera of Cordova (1 ♀, Sumichrast).

B. *Metathorax as in Section A, but the superior edges of its hinder plate not so much elevated, no longer forming, in the females, distinct teeth behind the post-scutel, nor even elevations separated from post-scutel by two fissures. Its edges still rather distinct, linear.*

a. Metathorax excavated; edges straight.

89. *O. Iturbidi* SAUSS. (Fig. 15, 15a.)—Validus, valde punctatus; post-scutello crenulato, metanoto perrugoso, utrinque angulato, marginibus superis rugosis, canthis oblitteratis, vix perspicuis; abdominis secundi segmenti margine profunde canaliculato, et valde rugoso. Caput et thorax nigra; ore, clypeo, orbitis partim, macula frontali, antennarum articulis 1-4, pronoto, macula subalari, scutellis, tegulis, metanoti angulis pedibusque, ferrugineis; abdomine ferrugineo, segmentis ochraceo-marginatis; primo et secundo basi incisurâ nigrâ; alis ferrugineis.

♂. Clypeo polygonali, truncato, integro; frequenter flavo.

Odyn. Iturbidi SAUSS. Rev. Zool. IX, 1857, 276, ♂.

Total length, 15 mm.; wing, 12 mm.

Size and form of *O. Boscii*. Head and thorax cribose with coarse punctures. Post-scutel strongly crenulate. Metathorax

very rugose, its posterior face concave and striate; its borders not trenchant but coarsely punctured, rugose, and forming on each side a dentiform angle rather than a tooth; its superior ridges hardly indicated, especially upon the summit, where they describe on each side a little arc, but without being at all terminated by a pyramidal point. Abdomen silky; the 1st segment bell-shaped, not being abruptly terminated anteriorly, but rounded, so that its anterior and superior faces are not separated by a ridge. Second segment short, having its border very strongly canaliculate, a little reflexed and very coarsely punctured; the canal rugose, and slightly widened angularly in the middle. Margin of the following segment very coarsely punctured, but not canaliculate.

Head black. Clypeus, mouth, and border of the orbits, ferruginous. Antennæ black, with the first three articles ferruginous. Between their insertion a ferruginous triangle. Thorax black. Prothorax, a spot under the wing, tegulæ, scutelli, angles of metathorax, and legs, ferruginous. Abdomen ferruginous; all the segments bordered with obscure yellow; the 1st and 2d having a little of black at their base; this color profoundly notched with ferruginous, and forming on the 2d segment a triangle, and on the 1st a lengthened spot in the form of a bottle, or variable. These colors are in fact quite variable; in certain specimens one sees some yellow appear on the clypeus, on the border of prothorax, on the post-scutel, and on the tibiæ; among other things, the abdominal segments hardly offer a yellow cloud. Wings ferruginous.

♂. Clypeus polygonal, as wide as long, truncate, not bidentate, ferruginous. Hook of the antennæ ferruginous.

?*Var.* The ferruginous parts of a pale red. Clypeus, mouth, frontal spot, a line on the scape of the antennæ, yellow. Ridges of metathorax a little less effaced; the canal of the border of 2d segment very wide and shallow. (Mesothorax offering two lateral red spots a little before the tegulæ. Articles 2 and 3 of the maxillary palpi slender.) Cordova.

The maxillary palpi of this *Odynerus* have their last three articles small, but not small enough to cause it to be placed in the genus *Rhynchium*, to which it bears, in fact, a resemblance.

Rees. a. diff.—It is very near to the *O. Guerrieri* and *Hidalgi*

Mexican var. (See the description of these species.) In colors it wholly resembles the *Ancistrocerus tuberculiceps*.

It has a greater relation in form to the *O. arvensis*, but it is a little larger, and it differs from it by the border of the 2d segment, which is not only depressed, but very subcanaliculate; and by the clypeus ♂ which is entire, not bidentate, but rather rounded on its anterior border.

Finally, it differs from the *O. dorsalis* ♂ by its wings, which are not violet; by the border of the 2d segment, which is not as distinctly reflexed as in the *O. dorsalis*, and by the summit of the metathorax, which does not offer post-scutellar crenulate eminences. The palpi are also a little more slender.

Hab. The hot parts of Mexico. I have taken 4 ♂ of this species in the valley of Mexitlan, and the var. in Cordova.

90. *O. bidens* SAUSS. (Fig. 14, 14a.)—Validus, niger, nitidus; metanoto postice late excavato, acute marginato, bidentato; clypeo ♀ ♂ apice truncato, haud bidentato; abdomine conico, sparse punctato, margine segmentorum 2ⁱ-5ⁱ densius punctato; pronoti et metanoti maculis 2, post-scutello abdominisque primo segmento superne, albidis; alia fusco-cyaneis.

♂. Clypeo albido, puncto mandibularum, scapi et frontis, maculisque 2 transversis in secundi abdominis segmenti basi, albidis; pedibus albido-variis.

Odyn. bidens SAUSS. Rev. de Zool. XXII, 1870, 58, 12.

Total length, 20 mm.; wing, 17 mm.

♀. A large species. Clypeus covered with separated points; its extremity abruptly truncate, not bidentate, and without depression. Head large, swelled at the vertex, shining, and covered with separated punctures. Thorax long, square, shining, finely punctured; prothorax hardly reflexed, not angulate, slightly retracted before; mesothorax marked with four grooves; post-scutel bent, transverse, joining in the truncation of the metathorax, but not crenulate. Metathorax presenting a great striate concavity, which occupies the whole width, bounded by very sharp ridges, which are separated from the post-scutel by a groove, and form on each side a dentiform lateral angle. Abdomen quite conical, the first segment wide, truncate before; the 2d quite long; its border carrying a wide, not very strong band of punctures; this band not channelled, but flat, as if planed; following segments punctured, with a similar band.

Insect of a shining black, clothed with a fine grayish pile; a spot behind each eye, two great spots on the prothorax, two on the metathorax, post-scutel, and the superior face of the first abdominal segment, of a whitish yellow (the band of the first segment often notched with black); wings of a deep violet-brown.

♂. Thorax more strongly cribose. Clypeus white, wider than long, polygonal; its inferior border straight truncate, not bidentate, finely bordered with black, a spot on each mandible, a mark on the front, another on the scape of each antenna, a dot under the wing, whitish. Antennæ terminated by a brown hook, a little rolled at the end. Second abdominal segment adorned on each side near its base with a transverse whitish spot. Haunches, tibiæ, and knees spotted with white. First abdominal segment wholly white above.

Revs. a. diff.—This *Odynerus* astonishingly resembles the *Monobia quadridens*, and it is rare to find two as distinct species which offer so close a likeness. The *O. bidens* differs from the *Monobia quadridens*, by its maxillary palpi composed of six articles,¹ and its labial palpi of four distinct articles; the fourth being articulate; by its clypeus, which is *abruptly truncate* in both sexes, and neither a little notched nor bidentate, and which is not excavated at the extremity with the female; by the post-scutel, more truncate, not binaemelionate, and by the very distinctly punctured flat band of the 2d segment; by the white spots of the metathorax (a character probably of little stability).

The *O. 4-sectus* has a livery similar to the *O. bidens*, but it possesses neither the metathoracic teeth, nor the sharp lateral ridges.

Hab. The southern United States. 1 ♀ from Florida (E. Norton); a ♂ from Tennessee (E. Falconet, Freudenreich).

Observation.—As this description is based solely on one individual of each sex, it may not apply to all specimens brought from localities distant from each other. It is probable that the male does not always offer the very singular lateral spots of the 2d segment.

b. *Metathorax more flattened; the superior edges roughened, not acute.*

91. *O. Alvaradi* SAUSS.—Niger, velutinus, confertim punctatus; abdomine conico, aureo-sericeo, marginibus crasse punctatis; metanoti

¹ The maxillary palpi have here the ordinary form which they assume among the *Odyneri*; the articles 2, 3 are not slender; the 6th is lengthened.

marginibus hebetatis at supra tenuiter prominulis, a post-scutello per emarginationem sejunctis; capitis maculis, linea in scapo, pronoti marginis postico, post-scutello, tegulis, macula prealari et puncto utrinque metanoti summi, margineque regulari segmentorum omnium abdominis, fulvo-ochraceis; tibiis et tarsis ferrugineis; alis ferrugineis; ♀ clypeo late piriformi, nigro vel superne fascia fulva; ♂ late truncato, bidentato, fulvo-flavescente.

Olyn. Alvarado Sauss. Rev. de Zool. IX, 1857, 276.

♀. Total length, 14 mm.; wing, 11 mm.

♂. Total length, 11 mm.; wing, 8.5 mm.

Size moderate. Clypeus ♀ wide, terminated by a little truncate or bituberculate point; cribose with strong punctures. Head and thorax rugosely punctured. Post-scutel very short, truncate, crenulate. Metathorax very rugose above; the striæ specially distinct in the inferior moiety, the superior moiety being more smooth and punctured; the inferior moiety forming a fossette, separate and slightly margined superiorly. Lateral border of the concavity rounded, not at all trenchant, the latero-superior parts coarsely punctured, rugose; nevertheless one sees on each side a little spiniform angle directed laterally and on the summit a trace of an arcuate ridge, placed a little within, especially among the males; superior angles ♂ forming two salients, rugose and blunted, separated from the post-scutel by a notch. Abdomen conical, like satin, with golden reflections, having the border of all the segments, save the first, quite strongly punctured; but the punctured band of the second quite wide and slightly impressed.

Insect black, clothed with tawny hair. Two spots on the summit of the clypeus, another behind each eye, a dot on the front, and a line under the scape of the antennæ, tawny. The summit of the clypeus is often entirely of this color, as well as the inner border of the orbits. Posterior margin of the prothorax, wing scales, a dot before the wing, post-scutel, and a dot on each side, on the summit of the metathorax, ferruginous or tawny. All the segments of the abdomen regularly bordered with yellow-tawny; the first more narrowly than the second. Legs black; tibiæ and tarsi ferruginous. Wings washed with ferruginous, a little grayish at the end.

♂. Clypeus as long as wide; its inferior margin widely truncate and armed with two little teeth separated by a wide straight border, in the middle of which is often a third indistinct salient.

Clypeus, a line on the mandibles, and the line on the scape of the antennæ, of a pale tawny.

Var. No spots on the front nor on the metathorax.

Res. a. diff.—This *Odynerus* is easily recognized by its livery and its velvety aspect.

It differs from the *O. Guerreri* by its conical abdomen and by the superior salients of the metathorax; from the *O. foraminatus*, by its metathoracic concavity, not nearly so well limited, and by the salients of the superior angles, which are not sharp, but rugose, obtuse, and separated from the post-scutel, not by a little fissure, but by a wide notch. By its livery it recalls the *O. otomitus*, which is near to it, but differs in its conical, sessile abdomen, having the first segment wide and truncate, in its great size, etc.

Hab. The hot and temperate parts of Mexico. (I caught 4 ♂, 2 ♀ in the valley of Mexilitlan.)

C. Hinder plate of metathorax no longer margined superiorly by sharp edges; the superior edges blunted and effaced by the rugosities of the latero-superior faces, which continue over the edges down on to the posterior face, and lose themselves in its concavity, instead of being separated from the hinder face by the sharp edges. (Lateral angles still existing.)

92. *O. arvensis* SAUSS. (Fig. 16, 16a.)—Medius, niger, grosse punctatus; *O. dorsali* similis at minor; ore, macula frontali et post-oculari scapoque subtus, rufis vel flavis; pronoti margine, post-scutello, maculis 2 metanoti abdominisque segmentis 10-30 vel 10-40 flavo-limbatis, 20-40 crassissime punctatis; primi margine utrinque aucto et rufo-vario, pedibus flavis, basi nigris, alis fumosis.

♀. Clypeo valde latiore quam longiore, truncato, grosse punctato, nigro vel rufo; superne fascia flava.

♂. Clypeo polygonali paulo latiore quam longiore, flavo, truncato, apice dentulis 2 distantibus instructo.

Odyn. arvensis SAUSS. Rev. de Zool. XXI, 1869.

♀. Total length, 14, 12 mm.; wing, 11, 5-9 mm.

♂. Total length, 12, 5-9 mm.; wing, 9-7 mm.

♀. Form rather near to that of *O. Boscii*, but smaller. The abdomen a little more conical; the 2d segment shorter and more coarsely punctured; its inferior border a little lamellate

and truncate, but often appearing slightly bidentate. Thorax widened before, retracted little or none. Post-scutel crenulate. Metathorax very coarsely rugose; its concavity striate, but cribose in its superior moiety from the punctures which continue with those of the superior face; the latero-superior ridges blunted, effaced; on each side a dentiform angle at the meeting of the lateral and inferior ridges. First abdominal segment silky, smooth, truncate, and a little rounded at the base; the 2d short, densely punctured; its posterior border offering a wide depressed zone, widened in the middle, very coarsely cribose, as well as the following segments; at times a little channelled, but the border not turned up.

Insect black. Mouth red, with a yellow spot at the base of the mandibles; superior moiety of the clypeus yellow or red; inner border of orbits and a spot behind each eye, red or yellow; scape of the antennæ red, with a black line above; a spot on the front, yellow or red. Anterior border of prothorax yellow, often followed with red; tegulæ yellow or red, post-scutel and a spot on each side of metathorax above, yellow; segments 1-4 of the abdomen regularly bordered with yellow; the first having its border on each side widened or confounded with a spot or oblique band, yellow surrounded with red, which leave above a black trilobed or square notch; often of red on each side or bordered with yellow. Legs yellow, black at the base. Wings smoky or a little reddened with a light violet reflection.

Var. a. Clypeus red, with a yellow band on the summit.

b. No red on 1st abdominal segment.

c. Two yellow or red dots on the scutellum (Tennessee).

d. Prothorax red, bordered with yellow (Missouri).

The crest of the post-scutel varies; sometimes finely crenulate and continuous, sometimes dentate and notched in the middle.

♂. A little smaller. Clypeus polygonal, yellow, wider than long, truncate on its anterior border, offering a very small tooth on each extremity of this border; its apical margin a little prolonged, so that the polygon is not regular, the inferior borders forming thus a larger arc than the superior; hook of the antennæ black or ferruginous; mandibles and ornaments of the head yellow or orange; a red dot on the flanks before the tegulæ; often the posterior border of the prothorax red and a little of red about the scutels; latero-superior borders of the concavity of the

metathorax very rugose, coarsely cribose. Fifth segment often bordered with yellow. With the male especially, the fossette of the metathorax does not reach the lateral borders, but is separated from them on each side by a band hunched and cribose with great pits; the superior ridges are often quite well defined.

In this species the yellow is clear; often almost orange. The red, the black, and the yellow are susceptible of changing places in the varieties.

Rees. a. diff.—This species greatly recalls the *O. dorsalis* and differs from it by its *clypeus* ♀ much wider than long and more grossly punctured; by the *clypeus* ♂ wider than long, not prolonged at its anterior extremity, and finely bidentate; by its smaller size; by its less obscure wings; by its metathorax less widely concave, becoming rounded and convex on the sides of the posterior plate, while, as with the *O. dorsalis*, the concavity occupies the whole width; the ♂ differs by the absence of pyramidal post-scutellar eminences formed by the superior termination of the ridges of the metathorax, and which exist in the *dorsalis* ♂. It has greater relationship to the *O. Boscii* and *Hidalgii*. It differs from this last by its blunted metathoracic borders, without salient ridges; by the border of segments 2d, 3d, which is impressed, rugose, but not turned up; from the first by the scutellum without spots; by the shorter 2d segment; the 3d and 4th more coarsely punctured; the 4th and 5th without any yellow border.

Hab. The United States, particularly the south. I possess some individuals from Tennessee, some also from Kansas, from Illinois (Kennicott), and from New York (E. Norton), 7 ♀, 10 ♂.

93. *O. annectens* SAUSS.—Validus, niger, fulvo-pilosus, clypeo piriformi flavo 4 maculato, apice emarginato; orbitis partim, pronoti margine antico, tegulis, punctis 2 scutelli, 2 metanoti, tibiis et tarsis, flavis; abdominis segmentis, 1^o superne flavo, nigro-marginato, 2ⁱ, 3ⁱ margine, crassissime punctato, anguste flavo-limbato; alis nigro-violaceis. ♀.

Odyn. annectens SAUSS. Rev. de Zool. XXII, 1870, 59, 14, ♀.

Total length, 17 mm.; wing, 15 mm.

The following description applies to an insect which seems to indicate a species different from *O. dorsalis*, but is certainly very embarrassing by its similarity.

♀. Size and form of *O. dorsalis*; the same sculpture, but not quite so rough. Clypeus pyriform, more prolonged than in *O.*

dorsalis; its apical margin *emarginate, concave*. Metathorax perhaps a little more depressed, without any superior ridges; its lateral angles very pronounced, compressed horizontally. First abdominal segment shorter than in *O. dorsalis*; the second rather velutinous, scarcely punctate, its margin more coarsely punctate (the punctures being rather holes), but not so evidently canalliculate as in *O. dorsalis*.

Insect black, with fulvous, velvety hair. Apex of mandibles and base of scape beneath, ferruginous. A spot on base of the mandibles, an ovate mark on both sides of the clypeus, and two others near the apex, inner orbits of the eyes and a line behind them, two triangular maculæ, forming the anterior border of prothorax, tegulæ except their base, two spots on scutellum and two on mesothorax, yellow; 1st abdominal segment yellow above with a trilobate black emargination; a narrow border of segments 2d, 3d of the same, yellow. Knees, tibiæ, and tarsi, yellow. Wings dark fusco-violaceous. The mandibles and palpi are formed as in *O. dorsalis*.

Hab. United States (Florida, 1 ♀, E. Norton).

94. *O. annulatus* SAY.—*O. arvensi* affinis, ♀ gracillior, ♂ capite majore, valde punctatus, secundo abdominis segmento dense punctato, margine impresso, crasse punctato. Niger vel ferrugineus, mesonoto et abdominis segmentis 3–6 nigris; tegulis, pedibusque rufis; pronoti et abdominis segmentorum margine, post-scutello metanoti marginibus, subfureis; primo abd. segmento utrinque rufo et flavo ornato; alia nebulosis. — ♀. Scape, clypeo, frontis maculis, rufis. — *Variat* clypei fascia nigra, macula subalari maculisque 2 secundi segmenti, rufis vel flavis. — ♂. Clypeo polygonali; fronte, scutellis, macula subalari flavis.

Odyn. annulatus SAY, Long's Sec. Exp. Append. 29 (II, 348).—Say's Ent. (LE CONTE), I, 235.—SAUSS. Et. Vesp. I, 232.—CRESSON, Amer. Ent. Trans. I, 1867, 380, 21.

Rhynchium annulatum SAY, Bost. Journ. I, 1837, 351, 4.—Say's Ent. (LE CONTE), II, 765, 3.—SAUSS. Et. Vesp. III, 184.

Odyn. Bairdi SAUSS. Revue Zool. X, 1858, ♂.

♀. Total length, 15 mm.; wing, 12 mm.

♂. Total length, 10 mm.; wing, 8 mm.

♀. Rather slender, densely and coarsely punctate. Clypeus broadly pyriform, strigate punctate, terminating in two approximate little teeth, separated by a small lamellar edge. Thorax subelongate. Post-scutel truncate, very tenuously crenulate.

Metathorax vertically truncate; concave, but its margins not ridged, the edges being quite blunted by the dense punctuation. **Abdomen** subconical, rather slender. The first segment smooth and silky; the second very short, densely punctate everywhere, but its posterior margin having a broad excavated band of very coarse punctures; segments 3-4 very coarsely punctured.

Black; mandibles, clypeus, scape of the antennæ, a frontal mark, and a large spot behind the eyes, rufous. Clypeus often with a transverse black line or with three black spots in a transverse line. Anterior margin of prothorax broadly, the posterior narrowly rufous, or partly sulphur-yellow; tegulæ yellow and rufous, often a yellow spot under the wing; post-scutel yellow; lateral margins of metathorax rufous or yellow. Abdomen having its first four segments margined with yellow; this color often preceded by a little of rufous. First segment black in middle; its sides rufous, with a yellow spot fused with the yellow band. Second segment often adorned with two separate rufous spots. Legs ferruginous; coxæ blackish. Wings grayish ferruginous, a little clouded or sometimes even with violet iridescence.

Rufous Variety.—Head rufous, except the vertex. Prothorax and feet rufous. Scutels yellow, or rufous, tinged with yellow; mesothorax black, with a rufous spot; metathorax rufous, marked with yellow. First and second abdominal segments rufous, margined with yellow; the second with two yellow maculæ; 3-5 segments rufous, margined with yellow; 6th rufous. Wings clouded (Kansas, New Mexico).

Various Varieties.—This is quite a variable species, the three colors interchanging, which gives numerous combinations. The scape is more or less obscure above. The spots on the clypeus, under the wing, on the second segment, are often wanting, etc. The yellow ornaments are of a pale sulphur-yellow.

I consider, as the male of this species, specimens from Texas and Louisiana, which last constitutes a still more rufous variety.

♂. Head large, wider than high, rufous, with black vertex. Clypeus broader than high, regularly octagonal; its anterior margin straight, having two insensible, distant teeth at its extremity. Mandibles, clypeus, a triangle on the forehead and sinus of the eyes, a line on the scape, bright yellow; hook of

the antennæ and flagellum beneath rather ferruginous; maculæ behind the eyes, orange. Thorax shorter, more cubical. Prothorax rufous margined with yellow anteriorly. Post-scutel and angles of metathorax yellow. First abdominal segment rufous above, surrounded with yellow; the mandible often black. Second segment having its marginal impressed band much impressed and broad; segments 1-5 margined with yellow. Coxæ and feet adorned with yellow (Louisiana).

Texan Variety.—Prothorax, scutels, metathorax, feet, segments 1, 2 of the abdomen, rufous. Disk of mesothorax rufous on each side. Border of prothorax, a dot under the wing, two spots on the tegulæ, scutel, post-scutel, edges of segments 1-6, bright yellow; the first segment having on each side a yellow spot smelted with the marginal fascia (Texas).

Mexican Variety?.—Smaller. Length, 13 mm.; wing, 10.5 mm.

♀. Black; mandibles, scape of the antennæ, forehead and the parts behind the eyes, prothorax, a lateral spot, tegulæ, two maculæ on disk of mesothorax, scutel, feet, and coxæ, rufous. Post-scutel yellow. Angles of metathorax rufous and yellow; abdomen rufous; first and second segment with a black portion in the middle and at base; all the segments margined with yellow; the first band fused on each side with a lateral square yellow spot, and the 2d segment having on each side a yellow spot, either free or confounded with the margin. Anus yellow. Wings washed with fuscous, with a golden, rather violet reflection; the radius ferruginous. The metathorax, although forming two lateral angles, is not toothed; the superior part of its posterior face is not margined on each side by an oblique ridge.

Var. Of course the ferruginous varies into yellow and *vice versa*, and the black is more or less developed.

Res. a. diff.—This species resembles *O. arvensis*, but it is more slender ♀; the male has also a more transverse, very regular polygonal clypeus, while in *arvensis* it is more prolonged at its extremity; in the female, the clypeus is on the contrary narrower than in *arvensis*. The post-scutel is not as strongly but quite delicately crenulate. The metathorax is not so sharp, and it has altogether another appearance. It approaches quite closely to *pratensis*, has the same look, but differs: by its 2d abd. segment not smooth, but densely and strongly punctured throughout; by

its rather bidentate metathorax; by its clypeus ♀ flattened, not so convex, ♂ shorter, not more prolonged below than above.

In the *Mexican variety*, the form is much as in *O. Cordovæ*, but it is larger; the clypeus ♀ a little produced at its apical end; head and thorax very coarsely shagreened; the second segment of the abdomen shorter, its margin having its coarsely punctured band impressed and widened in the middle.—This *var.* differs from *O. formosus* by its larger size, its clypeus more prolonged at tip, metathorax not bidentate, and darker wings; from *O. Hidalgoi* and *Iturbidi* by its smaller size and metathorax not acutely margined superiorly.

Hab. The prairies from Missouri to Texas and New Mexico. Mexican Cordillera (the variety) 5 ♀, 2 ♂.

95. *O. crypticus* SAY.—Rufus; abdomine flavo-trifasciato; alis infuscatis.

Odyn. crypticus SAY, West. Quarterly Reporter, II, 1, 1823, 80.—Say's Entom. (LE COXTE), I, 168.

Rhygchium crypticum SAY, Bost. Journ. I, 1837, 384, 3.—Say's Entom. (LE COXTE), 765, 3.—SAUSS. Et. Vesp. III, 184.

Total length, 5 lines.

Body rufous, much punctured; vertex and origin of the antennæ, black; antennæ dusky at tip; thorax with a black spot before the middle; scutellum bilobate, with a longitudinal, deeply impressed line; metathorax concave; wings dusky, paler at tip; tergum with three yellow bands, the anterior one smallest and subconcealed.

Hab. Arkansas.

This is most likely a pale variety of *O. annulatus*.

96. *O. sulfureus* SAUSS. (Fig. 18, 18a.)—♀ *O. arvensis* similis, at metanoto minus excavato; niger, sulfureo-multipictus; ore, clypeo et facie sulfureis; oculis flavo-, supra rufo-marginatis; antennis fuscis, scapo rufo; pronoto flavo, angulis posticis rufis; scutello flavo-bimaculato; post-scutello, tegulis maculis pleurarum et metanoti angulis, sulfureis, abdomine sulfureo, segmentis 10, 20 basi et in medio nigro-signatis; pedibus ferrugineo et sulfureo pictis; alis ferrugineo-griseis. ♀.

Odyn. sulfureus SAUSS. Revue de Zool. X, 1858, 170, ♀.

Total length, 12 mm.; wing, 9 mm.

Thorax much shagreened; post-scutel finely crenulate. Metathorax forming two lateral angles, its excavation only occupying the middle, rounded, strigose; the rest shagreened, strongly punctured, rounded, without sharp edges. Abdomen conical, scarcely contracted at base, truncate anteriorly, but without a sharp ridge, rounded at base. Second segment densely punctured; its margin having a wide impressed band, cribose with coarse punctures; the following segments similarly cribose.

Black: mandibles, clypeus, forehead, and orbits, sulphur-yellow; the upper part of orbits black or brown-rufous; frontal sulci black. Antennæ blackish; the first segment yellowish or rufous obscure above. Pronotum widely marginate with yellow; its posterior angles rufous or black; a spot and various marks under the wing, tegulæ, two spots on the scutel and sides of metathorax, yellow. Abdomen almost wholly sulphur-yellow; the base of first segment black or brown on its anterior face, with a black pyriform notch on the superior face; the 2d having at its base a black macula, constricted in the middle; the following segments twice notched with black or brown. The coarse punctures of the margins having their ground-color brown. Anus ferruginous or yellow. Feet yellow and ferruginous. Wings tinged with ferruginous, cloudy at the apex.—♀. Clypeus broad, pyriform, wider than long, its apex a little produced, truncate, biangulate.

Var. The black part of the body brown or rufous.

Probable Variety.—The yellow ornaments not so much extended; segments 1, 2 black, with a wide sulphur margin, widened on the sides; the 2d with two lateral triangular maculæ, as in *O. blandus*.

Revs. a. diff.—It has quite the form of *O. arcensis*; the metathorax is a little more flattened, principally on the sides of the excavation, which is a little narrower. It differs from *O. cingulatus* in its livery; these species are much the same in their forms.—It differs from *O. pratensis* by its biangulate metathorax. In the livery it resembles *O. blandus*, but is very distinct by its not angulate metathorax, its not crenulate post-scutel, its smaller and strongly punctured first abdominal segment, its narrower clypeus and its small size.

Hab. California (♀ Berton).

97. *O. formosus* SAUSS.—*O. Cordovæ* conformis, at metathorace distincte bidentato; abdomine magis conico; niger, mandibulis, clypeo, scapo, capitis maculis, fulvis; pronoto, tegulis, macula subalari, maculis 2 scutelli, post-scutello, metanoti angulis, abdominis segmentorum marginibus (primi limbo utrinque cum fascia obliqua conjuncta), pedibusque, flavis vel aurantio-variis; alis subferrugineis, apice griseis.

Odyn. formosus SAUSS. Rev. de Zool. XXII, 1870, 59, 15, ♀.

Total length, 10 mm.; wing, 8 mm.

♀. Size and form nearly as in *O. Cordovæ*, but the metathorax has its angles on each side produced into a distinct tooth; the cavity not at all limited, not margined superiorly on each side by a little oblique ridge; the abdomen quite conical, the first segment as broad as the second, and more sharply truncate at base; the punctured marginal band of the 2d segment decidedly impressed, a little widened in the middle.

Black; mandibles and feet rufous or orange. Clypeus, frontal, ocular and post-ocular maculæ, yellow or rufous. Antennæ black; scape yellow, a little obscure above. Prothorax, a spot under the wing, tegulæ, two spots on the scutellum, post-scutellum, angles of metathorax, and margin of all the abdominal segments, yellow or rather orange; the fasciæ wide; that of the first segment fusing into two oblique lateral bands, which make nearly an anterior interrupted fascia, sometimes rufous. Anus rufous or yellow. Wings rather ferruginous; the apex clouded.

Var. A. black spot on the posterior angles of prothorax.—A yellow fascia on scutellum.

Res. a. diff.—This does not seem to be a variety of *O. Cordovæ*. It has the same livery as *O. Boscii*, *turpis*, *molestus*, but a quite differently shaped metathorax; it is also smaller and more slender, nearly one-half smaller than the first. It resembles *O. sulfureus*, but its livery is not so rich nor so pale; the clypeus is not so much produced, the size smaller. It is allied closely also to *O. annulatus*, although smaller and with a metathorax not so much flattened behind. Comp. also *O. annulatus* (Mexican variety).

Hab. The temperate parts of Mexico. Oriental Cordillera 4 ♀ (Sumichrast).

98. *O. spectabilis* SAUSS.—Niger, gracilis; capite, thorace abdominisque segmentorum 2^a–5^a margine dense punctatis; metanoto rotundato, utrinque valde angulato; abdomine subconico; clypeo, antennis

basi, capitis maculis, thoracis margine antico late, macula subalari, tegulis, scutellis, metathorace utrinque, abdominis segmentorum marginibus, ano pedibusque, flavo-aurantiis, fascia 1^a segmenti utrinque aucta ♀.

Odyn. spectabilis SAUSS. *Revue de Zool.* XXII, 1870, 60, 16, ♀.

Total length, 9 mm.; wings, 7 mm.

Slender. Head and thorax rather coarsely and densely shagreened. Thorax square. Post-scutel crenulate, metathorax rather flattened behind, forming on each side a strong, acute angle looking outward, which makes the posterior part of thorax square, the middle of the hinder face a little excavated, rather rugose, but the cavity not margined; the rest quite rugosely punctured, reticulate. Abdomen nearly conical, smooth, silky; the 2d segment finely punctured, but its margin and those following strongly punctured.

Black. Antennæ black-ferruginous, with the first three joints ferruginous. Mandibles rufous. Clypeus, a frontal triangle, an ocular and post-ocular large macula, prothorax anteriorly, spot under the wing, tegulæ, scutel, post-scutel, angles of mesothorax and margin of all the abdominal segments, yellow, rather orange; the yellow margin of 1st segment fused with two large, lateral angular yellow maculæ; anus, feet, even the coxæ, orange-yellow. Wings washed with ferruginous; the radial cell cloudy.

♀. Clypeus wide, rather lozenge-shaped, with its apex truncate, biangulate.

Var. The last abdominal segments rufous.

Res. a. diff.—Recalls the *O. bacuensis* by its appearance, but is very distinct by its broad clypeus ♀, its crenulate post-scutel, angulate metathorax, and conical abdomen, etc. From *O. cubensis* and allies it differs by its more slender form and metathorax without acute superior edges.—From *O. formosus*, by a larger size and less slender form. If it was not as small again, it would agree perfectly with the description of *O. apicalis* Cress. It may be a small variety of this?

Hab. Cuba (1 ♀, Dr. Gundlach).

99. *O. apicalis* CRESSON.—Niger; clypeo, mandibulis, fascia frontali, antennis basi, pronoto, tegulis, macula subalari, scutellis, metathorace utrinque; pedibus abdominisque segmentorum 1-3 margine, flavis;

primo segmento superne flavo, disco nigro; segmentis 4-6 rufis; alis fusco-hyalinis.

Odyn. apicalis CRESSON, Philad. Ent. Proc. IV, 1865, 161.

♀. Total length, 6 lines; expanse of wings, 10 lines.

♂. Total length, 4.5 lines; expanse of wings, 7.5 lines.

♀. Opaque-black. Head and thorax deeply and closely punctured, the former broader than the thorax, rather short; a broad transverse band on the front, filling up the sinus of the eyes and deeply indicated above the insertion of each antenna; the broad posterior orbit and the clypeus, yellow, sometimes strongly tinged with ferruginous, sometimes yellowish at the base; clypeus depressed, rhomboidal, the extreme tip truncate. Antennæ black, the two basal joints ferruginous. Thorax: prothorax yellow above, tipped with dull ferruginous just before the tegulæ; pleura somewhat sericeous, with a large, rounded yellow spot beneath the tegulæ; scutellum with two large, quadrate, yellowish marks, nearly confluent; post-scutellum yellowish; metathorax finely and transversely striated, deeply excavated on the disk, with a large yellowish mark on each side, covering the lateral angles, which are rather prominent and obtuse; tegulæ yellowish, with a ferruginous dot on the middle. Abdomen ovate, basal segment nearly equal in width to the second; remaining segments gradually tapering to the tip, and more deeply and densely punctured than the basal segments; first segments rounded at base without suture or carina, the apical margin confluent, with a large angular mark on each lateral margin, yellowish; apical margin of the second and third segments (broader on the second segment), yellow; that on the third somewhat tinged with ferruginous; remaining segments, above and beneath, dull ferruginous; beneath, the apical margins of the second and third segments are narrowly yellowish, more or less sinuate on each side anteriorly.

♂. Smaller, the markings of the face tinged with ferruginous; the basal joint of the antennæ yellow within, with a black line above, the apical joint ferruginous and hooked; the yellow of the prothorax not continued all the way to the tegulæ, being interrupted with black; fourth segment of abdomen black, with the apical margin above and beneath, narrowly yellowish; remaining segments obscure yellowish-ferruginous, more or less dusky at base; beneath, the second segment with a yellow spot

on each side of the middle. Legs yellowish; the femora except tips beneath, the tibiæ beneath, and most of the tarsi, pale ferruginous. Wings subhyaline, faintly tinged with fuscous; honey-yellow along the costa, with the marginal cell almost entirely fuscous.

Res. a. diff.—Allied to *O. cubensis*, by its livery, but the face is much broader, and the basal segment of the abdomen is differently marked, rounded anteriorly, not truncate, with a sharp edge. It differs also by its hooked antennæ, in the male.

I do not know this *Odynerus*, which seems most closely allied to *O. spectabilis*, but much larger. Compare this species.

Hab. Cuba (Mus. of the Am. Ent. Soc., Philadelphia).

2. *Posterior plate of metathorax orbicular or more or less rounded, not forming on each side a distinct dentiform angle.*¹ (Thorax rather attenuate posteriorly, abdomen conical or ovate-conical.)

A. *Posterior plate of metathorax still margined with a sharp edge, salient in its superior part, and forming on each side of the summit a tooth or elevation, separated from the post-scutel by a fissure (sometimes very small).*

a. *The concavity deep, excavated, with salient ridges. Abdomen conical; its base sharply truncate.*

100. *O. turpis* SAUSS.—Niger, thorace crassissime punctato; clypeo lato, piriformi; metanoto attenuato, extus rugosissimo, postice in foveolam ovalem valde excavato, lævi, haud biangulato, sed canthis arcuatis acutis marginato, nunquam supra paene dentem post-scutellarem efficientibus; abd. 2ⁱ segmenti margine punctato sed haud impresso; clypeo summo maculis 2 vel fascia, orbitalum marginibus partim, macula frontali, scapo subtus, pronoti et abd. segmentorum 1ⁱ–4ⁱ margine, macula subalari, tegulis, scutelli et metanoti maculis 2, post-scutello pedibusque, aurantiacis; alis ferrugineo-fusco nebulosis.

Odyn. turpis SAUSS. *Revue, Zool.* XXII, 1870, 60, 17, ♀.

Total length, 13 mm.; wing, 11 mm.

¹ Sometimes there is still an indication of two angles or even a small tooth (*O. foraminatus*, *O. leucomelas*), in the species in which the posterior plate of metathorax is more or less angulate.

♀. Insect very coarsely punctured, recalling the *O. Boscii*, but more coarsely cribose and more retracted on the metathorax. Clypeus pyriform, wide, punctured, rather wider than long. Post-scutel feebly crenulate. Concavity of the metathorax occupying all its width, rounded, notably wider than high, excavated, finely striate and *smooth as far as the borders*; these are *extremely trenchant*, but not forming spiniform lateral angles; these ridges above all very salient on the summit, where they often terminate in a dentiform or lamellar salient, separated from the post-scutel by a strong notch. The external lateral surfaces of the metathorax very rugose. Abdomen conical truncate, at the base having a sharp ridge; the border of the second and following segments quite strongly punctured; but that of the 2d not sensibly depressed.

Insect black, clothed with tawny hair. Mandibles and at times the end of clypeus, red. Two spots or an arc at the summit of clypeus, a spot on the front, another behind each eye, and the inner bordering of the orbits, as well as a line on the scape of the antennæ, yellow. Border of the prothorax, a spot under the wing, tegulæ, two spots on the scutel, two others on the summit of the metathorax and post-scutel, yellow; segments 1-4 of the abdomen bordered with the same color; the first border widened on the sides; legs yellow, the base black. Wings transparent, washed with brown-ferruginous. The yellow of the ornaments is almost orange; it often passes, without doubt, into red.

Var. One specimen has its ridges blunted at the beginning or where the lateral angles would be, if they existed, but their summit always forms a trenchant prominence.

♂. Unknown.

Res. a. diff.—This species is allied to the *O. Boscii*, *arvensis*, *Hidalgi*, by the distribution of the colors. It has like the *O. Boscii* the scutel spotted with yellow, and like the other species the post-scutel yellow. But it is distinguished clearly from these species: 1st, by its retracted metathorax, not laterally bidentate, in consequence of the rounded posterior plate (not squarely cut), of which, however, the ridges are very sharp and quite arcuate (and not more or less straight or oblique as in the species cited); 2d, by the border of the 2d segment, which, although punctured, is not depressed, and less reflexed.

From other allied species with similar livery, or adorned with red, it always differs by its very sharp metathoracic ridges. (See especially the *O. molestus*.)

The great number of these species all having similar livery renders their distinction very difficult, so that one needs to be familiar with the details of the forms, above all with those of the metathorax, which furnish certain very distinctive characters.

Hab. The United States. 2 ♀ taken in Tennessee. Sent by E. Fr. Falconnet.

101. *O. Megæra* LEPÉL.—Niger, valde punctatus; metanoti foveola rotundata, striata, utrinque inermi, sed canthis elevatis acutissimis marginata; his supra in dentes 2 excurrentibus, a post-scutello per fissuram sejunctis; macula frontali et post-oculari, pronoti et abdominis segmentorum 1ⁱ, 2ⁱ margine, primi utrinque aucto, macula subalari et post-scutello, luteis; alis fusco-cyaneis.—♀. Clypeo piriformi nigro, fascia arcuata, vel maculis 2 luteis.—♂. Clypeo lato, albido, margine truncato, atro; scapo fascia albida.

Odyn. Megæra LEPÉL. St. Farg. Hymen. II, 636, 21 (1841).—SAUSS. Et. Vesp. I, 181, 74; pl. xvii, fig. 11, ♀¹; III, 232.

♀. Total length, 15 mm.; wing, 12 mm.

♂. Total length, 11 mm.; wing, 9 mm.

♀. Clypeus pyriform, longer than wide, cribose with coarse points, terminated by a very small border, at times smooth and lamellate, and appearing a little bidentate. Thorax retracted on the metathorax. Head and thorax densely cribose. Post-scutel truncate, offering a subcrenulate ridge. Metathorax rugose, having its *lateral* ridges blunted; its posterior plate concave, striate, and a little punctured on its borders; form rounded, but wider than long; bordered with sharp ridges, but not forming any lateral spiniform angles.

These ridges a little crenulate; their summit separated from the post-scutel by a narrow fissure. Abdomen densely punctured, abruptly truncate: at its base a sharp ridge; the border of the 2d and the following segments very coarsely cribose, but the border of the 2d without any depressed zone.

Insect black, clothed with a grayish pile. A spot on the

¹ The ornaments are too yellow on this figure in a number of the copies of this work.

mandibles, an arc or two spots on the summit of the clypeus, a dot on the front and another behind each eye, the border (retracted in the middle) of pronotum, a spot under the wing, post-scutel, often a dot at the wing scale, and the border of the first two segments of the abdomen, of a whitish-yellow; the border of the first segment widened on the sides; often tri-emarginate. Wings of a brown-violet; tarsi brownish.

Var. a. Beneath the scape a ferruginous or whitish line; the 3d abdominal segment adorned with a whitish edging.

b. Clypeus and antennæ wholly black.

c. Tibiæ marked with white on their outer border (Illinois).

♂. Smaller. Clypeus polygonal, slightly prolonged at the end and truncate, subbidentate, its color whitish, with the inferior borders black; hook of the antennæ great; on the scape a white line. Metathoracic ridges salient on the summit, terminated behind the post-scutel by a more elevated pyramidal tooth.

Var. The ornaments passing into sulphur-yellow.

Rees. a. diff.—This *Odynerus* is easily recognized by its whitish ornaments. In likeness it resembles:—

1. The *O. bidens* and the *Monobia 4-dens*, from which it is distinguished easily by its small size, by the absence of lateral teeth on the metathorax, by the cribose thorax, and the rugose metathorax, etc.

2. The *O. 4-sectus*, from which it separates itself by its livery and its quite differently formed metathorax.

3. The *O. leucomelas*, from which it differs by the livery of its abdomen, by the whitish band of its 1st segment, widened on the sides, by its abdomen truncate, with a sharp ridge at the base; by its metathorax with elevated borders; by its violet wings.

4. The *Ancistrocerus albophaleratus*; from which it differs by its livery and by the absence of a suture on the first abdominal segment.

In the distribution of colors it approaches the *O. foraminatus* and allies.

Hab. The United States. Carolina, Tennessee, Illinois (Kennicott), Florida (Norton), 8 ♀, 11 ♂.

- b. *Posterior plate of metathorax less excavated; its marginal edges but slightly salient, although still sharp. Abdomen ovate-conical, slightly attenuated at base.*

102. *O. foraminatus* SAUSS.—Niger, confertim punctatus; metanoti rugosi foveola rotundata, striata, utrinque inermi, marginibus rotundatis, haud acutis, superne tantum in dentem verticalem excurrentibus, a post-scutello per fissuram sejunctum; macula frontali et post-oculari, linea in scapo, pronoti et abdominis segmentorum marginibus, tegulis, post-scutello, macula subalari, tibiis tarsisque, sulfureis; alis diaphanis fusciscentibus.—♀. Clypeo piriformi, biangulato, nigro, supra fascia arcuata flava.—♂. Clypeo polygonali, vix emarginato, flavo.

♀. Total length, 13 mm.; wing, 11 mm.

♂. Total length, 11 mm.; wing, 10 mm.

Odyn. foraminatus SAUSS. Et. Vesp. I, 180, 73, ♀¹ (1852); III, 232.

Odyn. rugosus SAUSS. Ibid. I, 179, 72, ♂ (1852).

♀. Smaller than the *O. Megæra*. Clypeus pyriform, longer than wide, strongly punctured, terminated by a little straight border, the angles of which are formed like two little teeth. Thorax having almost the same form as in the *O. Megæra*, although a little narrower; the head and the thorax strongly punctured. Post-scutel finely crenulate. Metathorax rugose; its concavity striate, rounded, being scarcely bordered, but its borders blunted by punctures which are continued with those of the superior face of the metathorax; one sees, however, the superior ridges slightly defined on each side; all on the summit forming a little vertical and sharp tooth placed on each side behind the post-scutel and separated from this last by a fissure. Lateral faces of metathorax finely rugose, becoming coarser toward the posterior border. Abdomen densely punctured, not being conical as in the preceding species, but rather ovalo-conic, widening slightly as far as the extremity, or as far as the middle of 2d segment; the first segment rounded, though truncate; a little widened behind. The border of 2d and the following segments very coarsely punctured; that of the 2d a little depressed, but not offering a clearly defined impressed zone; the punctures gradually augmenting in size; the following segments cribose with great pits.

¹ *Erratum.* Line 7th from the bottom, in place of: *écusson*, read: *post-écusson*.

Insect black, clothed with a brownish or grayish pile. A spot on the summit of the mandibles, an arcuate band or two spots on the summit of clypeus, a spot on the front, another behind each eye, a line on the scape of antennæ, a narrow line on the anterior border of prothorax, tegulæ, a spot under the wing, post-scutel, knees, tibiæ, and tarsi, yellow. The first four or five segments of the abdomen regularly bordered with yellow; the border of the first confounded on each side with a spot or an oblique lateral line. Wings transparent, smoky, with some violet reflections; nervures brown. A red or brown dot on the wing scales. (The wings are at times slightly ferruginous.) The last article of the tarsi at times brown.

Var. a. Two yellow dots on the superior faces of metathorax, placed on each side of the post-scutel (Tennessee).

b. Often two yellow dots on the scutel and the lateral spots of the first segment lengthened, oblique (Illinois).

c. Smaller. Clypeus yellow, polygonal, as long as wide, terminated by a slightly concave border, appearing bidentate if looked at beneath. A yellow line on the mandibles. Hook of the antennæ ferruginous beneath. Last article of tarsi often black. The intermediate thighs often varied with yellow.

Var. Frontal and post-ocular spots almost nothing. Borderings of the abdomen very narrow. Wings hyaline. In the two sexes the superior teeth of the metathoracic ridges are often but little developed, indistinct, or even wanting. One also remarks variations in the punctuation of the border of the concavity of the metathorax. The extremity of the clypeus is often hollowed by a fossette which gives it the appearance of being notched and bidentate.

Res. a. diff.—This species has the same distribution of colors as the *O. Megæra*, but its ornaments are of a lively yellow and not whitish. Besides, the abdomen is less conical; the clypeus ♀ has its angles more salient and the metathorax is not bounded by distinct and trenchant ridges without. The two superior teeth of the metathorax are as strong as they are well developed. *The wings are less obscure.*

The *O. foraminatus* somewhat recalls also the *Ancistrocerus campestris*.

Finally, it resembles in so striking a manner the *O. trilobus* Fabr., that one will be tempted to take it for an American variety.

of this species so common in Asia and Africa; but the clypeus is always wider, the abdomen is less coarsely and more densely punctured, the first abdominal segment does not offer the spot trilobate with black peculiar to this species, and the border of the 2d segment is more coarsely cribose.

Hab. The United States, from Tennessee as far as Canada. Tennessee (E. Fr. Falconnet), Illinois (Walsh. Kennicott), New York (E. Norton), Pennsylvania (Rathvon, Haldeman), Connecticut (E. Norton), Wisconsin. 17 ♀, 20 ♂.

103. *O. leucomelas* SAUSS. (Fig. 19, 19a.)—Niger, punctatus, cinereo-hirtus; thorace postice attenuato; abdomine ovato-conico; metanoti foveola sat planata, striata, utrinque subangulata, marginibus superis tenuiter acutis, rectis, supra in dentem acutum terminatis, a post-scutello per fissuram sejunctum; clypei ♀ maculis 2 vel fascia, puncto frontali et post-oculari, pronoti et abdominis segmentorum limbo anguste, post-scutello, tegulis tibiisque extus, albidis; alis subhyalinis.—♂. Clypeo bidentato, ore, antennarum scapo subtus pedibusque partim, sulfureis.

Olyn. leucomelas SAUSS. Et. Vesp. III, 225,¹ 131 (1854).

♀. Total length, 14 mm.; wing, 10 mm.

♂. Total length, 9 mm.; wing, 7.5 mm.

♀. A little larger than the *O. foraminatus*, but the abdomen is a little more ovate-conic, the first segment a little narrower. Clypeus pyriform or rounded, strongly punctured, terminated by a very little biangulate border. The whole insect finely punctured; thorax slightly depressed, widened in the middle, retracted behind; post-scutel finely crenulate. Truncation of metathorax occupying its whole width, but the posterior plate slightly concave, quite flat, in form angulate-rounded, equally striate throughout, forming on each side a rounded angle, at times slightly salient in the form of a tooth. Latero-superior ridges straight, fine and trenchant, although very little salient, each terminated superiorly by a sharp tooth, directed upward, and separated from the post-scutel by a narrow fissure. Abdomen quite ovate, especially among the males; the 2d and following segments quite strongly punctured on the border.

Insect black, clothed with a grayish pile. A spot on the

¹ In the description of this species, all that which treats of the thorax is omitted. Another of the numberless negligences of the printer!

summit of the mandibles, two on the summit of the clypeus, a dot on the front, another behind each eye, a narrow border on the prothorax, wing scales, a dot under the wing, post-scutel, a quite regular narrow bordering of the segments of the abdomen, and 2d and 3d tibiæ without, whitish. Tarsi and knees ferruginous. Antennæ wholly black. Wings transparent, or subsmoky; a brown spot on the wing scale.

Var. a. Clypeus ornamented with a whitish arcuate band on the summit. The bordering of the first segment mingled with a white lateral dot.

b. The last segments without border.

c. No spots under the wing.

♂. Clypeus bidentate, yellow; labrum, mandibles, the frontal spot, a line on the scape of the antennæ, the hook of antennæ, tibiæ, tarsi, intermediate thighs beneath, and coxæ 2, 3, yellow. No spots under the wing.

Res. a. diff.—This species resembles above all—1st the *O. foraminatus*, from which it is distinguished by its less concave metathorax, the concavity less rugose, having the superior ridges straight and pronounced, its antennæ black, its ornaments white, etc.—2d, from the *Ancistrocerus albophaleratus*, which is almost identical in form and livery, but from which it is clearly distinguished by the absence of the suture on the first abdominal segment, and which has the scutel spotted with whitish, with the post-scutel black.—3d, from the *O. Megæra*, which has the posterior plate of the metathorax much more concave, and of a rounded not angulate form, the wings black, and only two whitish bands on the abdomen.

Hab. The northern United States. Connecticut (E. Norton), Illinois (Kennicott), 3 ♀, 1 ♂. (1 ♀ from Fort Tejon. Latit. 35°, longit. 119°; altit. 4600 feet.)

Observation.—This species, so very near by the form and livery to the *Ancistrocerus albophaleratus*, approaches very much also in the form of the metathorax to the *Ancistrocerus* group of the species cited. One would say that these two species issue from the same stock, of which the form of the 1st abdominal segment is bifurcate, while the livery has continued the same.

104. *O. blandus* SAUSS.—Niger, nitidus, dense punctatus; metathorace inermi, rotundato; abdomine ovato-conico; antice truncato, sessili; corpore sulfureo-multipecto; abdominis segmentis 1–5 sulfureo-limbatis, 1^o et 2^o insuper utrinque fascia trigonali sulfurea (vel fascia antica interrupta); pedibus flavis; alis subhyalinis.—♀. Clypeo et orbitis partim flavis.

Odyn. blandus SAUSS. *Revue et Mag. de Zool.* XXII, 1870, 105, 27, ♀.

Total length, 9 mm.; wing, 7 mm.

♀. Clypeus pyriform, flattened, rather strigose, truncate at tip and rather rounded. Head and thorax densely punctate; post-scutel quite shortly truncate, quite linear, transverse, but rounded, not crested; its hinder face rather oblique, punctured; this form being the transition to the *Stenodynerus*. Metathorax small, short, and rounded, not angulate, shallowly punctured; its excavation strigose, not sharply margined, except superiorly, where it forms a little ridge or tooth behind the post-scutel. Abdomen ovate-conical; the first segment not quite as wide as the second, scarcely truncate anteriorly, but without a sharp ridge, sessile; its superior face slightly depressed, as punctate as the thorax; 2d segment densely punctate, but not quite as strongly, its hinder margin more strongly so, and densely punctured, slightly and widely depressed; the following punctured.

Black, shining; a line on the mandibles, clypeus, inner orbits, frontal spot, a line behind the eyes, the scape beneath, a wide, but interrupted anterior margin of prothorax, a spot under the wing, tegulæ, a dot on mesothorax before the scutel, post-scutel above, and sides of metathorax, sulphur-yellow. All the segments of the abdomen margined with sulphur-yellow. The first, in addition, with two oblique yellow bands or maculæ, fused with the yellow bordering laterally; the 2d adorned on each side with a large triangular macula, forming a wide interrupted fascia beneath; this segment has similar yellow ornaments. Anus black. Feet yellow; coxæ black; the 2d and 3d pair margined with yellow and spotted at tip. Wings subhyaline, nerves brown.

Var. ♀. Clypeus with a central black spot.

Res. a. diff.—In its rather stubbed form it recalls the form of *O. Catskillensis*, but its abdomen is still more sessile, more truncate anteriorly, and more square. By its rich livery it recalls *O. sulfureus*, but is very distinct from it by its non-angulate

metathorax, more slender form, etc. This is rather an intermediate type between *Division Odynerus* and *Stenodynerus*, by the quite linear form of its post-scutel, not flattened above and ridged posteriorly; and by its abdomen, although sessile and truncate at base, having the 1st segment more punctured than the 2d at base.

Hab. California (E. Norton).

B. *Posterior plate of metathorax no longer margined with sharp ridges, but having its edges blunted by the rugosities or the punctures (or not rugose); and the summit of the ridges no longer forming post-scutellar teeth, although still separated from the post-scutel by a groove.*

a. *Posterior plate of metathorax much excavated, margined with salient, blunt, and rough edges. Abdomen conical, its base sharply truncate.*

105. *O. molestus* SAUSS.—Niger, tomento cinereo hirsutus; thoracæ nitido grosse punctato; metanoto perrugoso, haud bidentato, foveolæ striatæ marginibus prominulis sed perrugosis, haud acutis; abdomine conico, segmentorum 2-5 margine percrasse cribratis; macula frontali et post-oculari, pronoti et abdominis segmentorum 1-4ⁱ limbo, macula subalari, tegulis, scutelli maculis 2, post-scutello, metanoti summi punctis 2 pedibusque, flavis.—♂. Clypeo latiore quam longiore, flavo, valde punctato, antice attenuato, truncato; mandibulis, oculorum margine intus, scapo subtus, flavis.—♀?

Odyn. molestus SAUSS. *Revue et Mag. de Zool.* XXII, 1870, 61, 19, ♂.

Total length, 11 mm.; wing, 9 mm.

♂. Size and appearance of the *O. arvensis*, but the thorax shining and more coarsely cribose with more separated punctures. Post-scutel crenulate. Metathorax but little retracted, very rugose; its posterior face not bidentate, strongly excavated, the borders very salient, but not at all trenchant; being on the contrary blunted, rounded by very coarse punctures. At times the borders are a little channelled because of these punctures; their summit is separated from the post-scutel by a fissure, but does not form any salient angles. Abdomen conical, having the same form as the *O. arvensis*; the first segment truncate, having a *sharp angle*; the 2d very short, its posterior border impressed and very coarsely cribose, as are also the following segments.

Insect black, bristling with grayish hair (among fresh specimens the abdomen is almost velvety). A spot on the front, another little one behind each eye, anterior border of prothorax, tegulæ, a spot beneath the wing, two on the scutel, post-scutel, and a spot on each side of this on the summit of metathorax, yellow or a little red. The first two segments of the abdomen bordered with yellow; the border of the first joined on each side with an oblique red or yellow spot; the segments (♀ 3-4), ♂ 3-5 bordered with a fine yellow edging. Legs yellow, at the base black. Wings transparent, a little smoky; nervures brown. Wing scales spotted with red or brown.

♂. Clypeus yellow, strongly punctured, wider than long; its inferior extremity slightly prolonged and truncate in middle. Mandibles, scape of antennæ beneath, inner border of orbits, and femora above, yellow. Hook of the antennæ ferruginous.

Res. a. diff.—This resembles divers species, particularly the *O. arvensis* ♂, but the clypeus is much more coarsely punctured, wider in proportion, with the extremity narrower and not bidentate. It differs from others: from *O. arvensis*, *Boschi*, *Hidalgii*, and *Iturbidi* by its metathorax, which is not bidentate and very much more excavated.—It is easily distinguished from the *O. foraminatus* ♂ by the form of its clypeus, by its more coarsely punctured thorax, by the metathorax surrounded by more salient borders, and very much more rugose, not forming behind the post-scutel the two little separating teeth; by the two yellow spots of the scutel; by its very conical abdomen, truncate at its base, with a sharp ridge. But it offers an appearance wholly, similar to the *O. turpis*; the same size, the same form, the same livery, so far that one would readily take it for the male of that species. However, it differs from it essentially by the borders of its metathorax, which are blunted, rugose, and not at all trenchant, while in the species of this group the ridges are in general more trenchant at the summit among the males than in the females. Yet the resemblance is such between these two insects that I remain in doubt if they are not the two sexes of the same species, the rather that with the *O. turpis* (♀) the ridges are often blunted toward the base.

Hab. The United States. 2 ♂ from Tennessee.

b. Posterior plate of metathorax more flattened; its margins rounded and punctured.

* *Abdomen conical, principally among the females.*

106. *O. pratensis* SAUSS.—Pallide-ferrugineus, citrino multipictus; thorace polito, grosse et sparse punctato; metanoto rotundato, dense punctato, velutino, utrinque inermi, superne canthis nullis, foveola striata minuta orbiculari; abdomine conico, segmentorum 2^l-5^l ♀, 2^l-6^l ♂ margine punctis fuscis crassis sparse cribrato; clypeo paulo latiore quam longiore, truncato; antennis basi aurantiis, in dimidio terminali superne nigris vel fuscis; abdominis segmentorum 1^l, 2^l fascia marginali citrina utrinque dilatata.

Odyn. pratensis SAUSS. *Revue et Mag. de Zool.* XXII, 1870, 61, 20, ♀ ♂.

♀. Total length, 15 mm.; wing, 11 mm.

♂. Total length, 12 mm.; wing, 9 mm.

♀. Size a little superior to that of the *O. foraminatus*. Punctures of body of little depth, but quite coarse. Scutel smooth, with some coarse, separated, irregular punctures. Post-scutel crenulate. Metathorax rounded, offering a little circular, striate concavity; but its circumference is perfectly rounded, densely punctured, without any spiniform angle, nor any ridge; not forming behind the post-scutel any kind of teeth, and velvety. Abdomen ♀ very conical, truncate anteriorly, but without sharp ridge. Border of segments 2^l-5^l (2^l-6^l, ♂) cribose, with very gross impressed points, a little separated, brown in their depth, and forming on the 2d segment an impressed zone.

Insect of a ferruginous orange, garnished with yellow or gray hair; mandibles, clypeus, the whole face, and a little post-ocular space, sulphur-yellow; a brown band on the vertex; antennæ red, clouded with yellow, with their second moiety black above, and the scape adorned with a yellow line. Middle of the prothorax, a spot under the wing, tegulæ, post-scutel, and sides of metathorax, yellow; scutel orange, varied with yellow; disk of mesothorax red, clouded with brown. All the segments of the abdomen widely bordered with yellow; bordering of 1st and 2d squarely widened on the sides; anus yellow; femora and tibiæ varied with yellow. Wings transparent, gray at the end, a little ferruginous along the side.

Var. a. Mesothorax obscure, with two ferruginous lines.

b. Yellow bordering of prothorax complete.

♀. Clypeus yellow, coarsely punctured, a little wider than long, terminated by a little lamellar border; mandibles yellow or red.

♂. Smaller. Head wide. Clypeus polygonal, more widely truncate. Legs yellow. (Antennæ?.)

Res. a. diff.—This species varies without doubt infinitely in its colors, passing probably in one place to brown or to black in its deeper color, or preserving its yellow ornaments more or less reduced; in another place changing from yellow, by the paling of its deeper color, and the extension of its ornaments, as we have shown above for the *O. annulatus*. It will not do then to seek its distinctive characters elsewhere than in its form.

It is easily confounded with the *O. annulatus*, which has almost the same livery and the male of which also presents a great head. It is distinguished from it by its greater and less dense punctures, the thorax remaining smooth for this reason; by the absence of lateral dentiform angles on the metathorax; by the punctures of borders of segments 2-4, which are greater, and separated, and of a brown color; the ♂ also by its shorter clypeus, which is not regularly octagonal, the inferior borders not being identical with the superior, the inferior being a little more prolonged.

The *O. pratensis* differs from the *O. foraminatus* by its metathorax, having a smaller concavity, less surrounded by swellings, with more rounded borders, more circumscribed, less extended, as far as the borders of the posterior face; and by the *absence of little teeth* behind the post-scutel; by a shorter and wider clypeus, etc.

It differs from the *O. Guerreri* by its more conical abdomen, by its less densely cribose, and not velvety body, etc. Otherwise, its color is of a gay orange-red, common to insects of the western coast of North America, and not of the brownish-red peculiar to the Mexican insects.

Hab. Lower California and the prairies of New Mexico. ♀ from Cape St. Lucas (Lower California, G. Xantus); ♂ from New Mexico.

** Abdomen more ovate-conical, slightly contracted anteriorly.

107. *O. flavopictus* SAUSS.—*O. foraminatus* simillimus, sed metathoracis dentibus superioribus nullis; clypeo latiore, flavo, nigro-margi-

nato, in medio signatura nigra; abdominis secundi segmenti margine crasse punctato sed nec impresso, nec rugoso, ♀.

Odyn. flavopictus SAUSS. Rev. et Mag. de Zool. IX, 1857, 276.]

Total length, 11 mm.; wing, 9.5 mm.

Very similar to *O. foraminatus*; a little smaller, and differing by its clypeus being a little more triangular, and principally by its metathorax, destitute of sharp edges superiorly, not forming behind the post-scutel two teeth separated by a fissure.

♀. Rather slender. Clypeus wide, its apex narrowly produced, a little excavated, bidentate. Post-scutel not crenulate. Concavity of metathorax finely striate; its edges roughly punctured, not margined superiorly by any sharp edges. Abdomen a little more contracted anteriorly. The whole body more finely punctured; the margin of the 2d abd. segment strongly punctured, but not rugose; more impressed.

Black, with the same ornaments as *O. foraminatus*; all the abdominal segments margined with yellow; the border of the first segment widened on the sides, with three black notches. Clypeus yellow, with a central black spot, and its apex margined with black. Wings washed with fuscous, with bronze reflections.

Hab. United States. Tennessee.

This may be a variety of *O. foraminatus*, with imperfectly developed form.

108. *O. Guerreri* SAUSS.—Obscure rufus et niger, rugose punctatus, fulvo-hirsutus; clypeo truncato; post-scutello ♀ bigibboso, ♂ 2-vel 4-dentato; metathorace ubique obtundato, dense punctato, foveola striata minore, nullomodo acute-marginata canthis nullis; abdomine ovato-conico, marginibus segmentorum 2ⁱ et sequentium grosse punctatis; secundi valde impresso; antennis rufis, apice nigris; capite nigro, orbitis ♀ omnino rufo-marginatis nec non in vertice summo; vertice ♀ fascia rufa transversa ornato; thorace rufo-maculato, pronoto rufo; abdomine rufo; segmentis omnibus rufo-marginatis, 10, 20 basi nigro-variis; alis fusco-nebulosis, costa ferruginea.

Odyn. Guerreri SAUSS. Revue et Mag. de Zool. IX, 1857, 277.

♀. Total length, 12 mm.; wing, 10 mm.

♂. Total length, 9.5 mm.; wing, 8 mm.

♀. Insect quite slender, of an obscure red, velvety. Head and thorax densely cribose; scutel divided by a longitudinal groove;

crest of post-scutel insensibly bituberculate. Concavity of metathorax quite small, the striæ parted in the middle by a carina; its borders completely rounded and punctured, forming no trace of a salient behind the post-scutel. Abdomen truncate anteriorly; second segment rather wider than long, a little wider than the first; its border offering a wide impressed zone, roughly cribose with separate punctures, insensibly crenulate. Borders of the other segments very coarsely punctured.

Insect black, velvety, garnished with an abundant woolly, tawny pile. Clypeus, mandibles, a spot on the front, and the complete border of the orbits, as well as the vertex, ferruginous; one sees beside on the vertex a transverse band of this color which joins the summit of the two eyes. Antennæ ferruginous, with their second moiety black. Prothorax, tegulæ, a spot under the wing, scutel and post-scutel, wholly or in part, and angles of metathorax, of an obscure ferruginous; there is often a ferruginous spot at the base of mesothorax also. Abdomen silky or woolly, ferruginous, with the border of all the segments, yellow; the base of the first two black, which forms variable designs. Legs ferruginous. Wings ferruginous along the side, a little smoky in the rest of their extent, the radial cellule obscure.

Var. a. The little channel of second segment almost null in certain specimens.

b. Metathorax black; scutel black, with two red spots; the black strongly extended on the first two segments of abdomen.

c. The scape blackish above; vertex without red transverse band; legs black and yellow.

d. Clypeus, ornaments of the head, scutel, tegulæ, spots under the wings, passing into yellow.

♀. Clypeus wide, strongly punctured, its inferior margin truncate, the angles forming two little salients.

♂. Clypeus polygonal, truncation almost straight, yellow. Post-scutel bidentate or 4-dentate, or denticulate; 2d segment very short, concave, its border very rugose, at times a little channelled. Vertex generally black, bordering of orbits incomplete at the summit.

Var. The first segment black, bordered with yellow; the bordering joining with two red lateral spots; the 2d black, red on the sides.

Res. a. diff.—This species has rather nearly the same color-

tion as the *O. turbide* and *Hidalgi* (var. Mex.); but it differs by its smaller size, by its bidentate post-scutel, by its smaller concavity which only occupies the middle. The male greatly resembles the *O. molestus*, but is distinct from it by the metathorax having its borders more regularly rounded, regularly punctured, not rugose, not angulate at the summit, nor quite so elevated as to be separated from the post-scutel by a fissure; by the more oval abdomen, by its antennæ, red in their first moiety, etc.

The species closely approaches also to the colors of the *O. Morelii*, and the *Ancistrocerus tuberculiceps*. (See the description of these species.)

Hab. The temperate parts of Mexico. I took 4 ♀ and 9 ♂ in the beautiful valley of Mexitlan; one ♀ on the confines of Morelia, in Mechoacan; and 2 ♀, 3 ♂ in the hot parts of the province of Mexico (Cuautla).

109. *O. Romandinus* SAUSS.—*Satis gracilis, nigro-velutinus, pilis longis fulvis hirsutus; post-scutello haud acute truncato; metanoto haud angulato; puncto post-oculari, pronoti, tegularum, abdominisque segmentorum 1-3 margine, flavo; post-scutello fascia flava; alis infuscatis, fusco-purpureo nitidis.*—Clypeo ♀ nigro; ♂ aurantio, basi nigro.

Olyn. Romandinus SAUSS. et Vespides, I, 184, 79.

♀. Total length, 11 mm.; wing, 8.5 mm.

♂. Total length, 9 mm.; wing, 8 mm.

Rather slender, very finely punctured and velutinous throughout. Post-scutel depressed, not sharply truncate. Metathorax very slightly excavated, not angulate; the excavation not margined; superiorly, continued without limits from the superior part; the lateral edges continued with the inferior edges. Abdomen ovate-conical, a little depressed; the first segment not as wide as the second, bluntly truncate anteriorly, and more strongly punctate. Second segment having at base beneath a transverse tubercle.

The whole insect of a deep velvet black, and all bristling with long fulvous hair. Antennæ and head black; a little yellow spot behind the eye. Anterior margin of prothorax with a narrow yellow band; margin of wing scales, a fascia on the post-scutel, and the margin of the 1-3 abd. segments narrowly yellow; the 3d margin quite narrow. Wings fuscous, with brown and violet iridescence. The ornaments are of a golden sulphur-yellow.

Var. Post-scutel black, without yellow band.

♀. Clypeus pyriform, truncate, bidentate or biangulate at tip, coarsely punctured near the extremity; adorned with two yellow lines at its apex.

♂. Clypeus elongate, a little bidentate at the apex, the inferior part occupied by a large orange macula; its teeth and apical edge black. Hook of the antennæ small, black.

Var. The orange macula of the clypeus much extended.

Res. a. diff.—A very distinct species, having quite the characters of the Odyneridæ of the northern Andes of South America, velutinous, grisly with long black hair. This insect forms somewhat a transition to the *Hypodynerus*; it lives also quite on the northern limits of the distribution of this group of insects.

Hab. New Granada. Sta Fé de Bogota, 2 ♀, 2 ♂.

SECTION II.—*Body still stubbed, not slender, nor cylindrical.*

Abdomen not conical, but remaining sessile; the 1st segment smaller than the 2d, as strongly or more strongly punctured than the 2d; the 2d constricted at base to fit into the first and more or less deformed; having its margin very strongly canaliculate and reflexed, and more or less swelled before the channel.

This group is formed for exceptional types, still belonging to the Division *Odynerus* by their general aspect, but passing to *Stenodynerus* by the form of the abdomen, which is no longer conical or ovate-conical, but more narrow anteriorly, and by the scutel, which is not so distinctly truncate, nor ridged on the line of the truncation. The two species which follow are approximate in the form of the abdomen, but very different in that of the clypeus ♂.

A. *Metathorax not narrowed below, much excavated, with very sharp edges; post-scutel bituberculate; abdomen quite deformed.*

110. O. cluniculus SAUSS.—Niger, crassissime cribri instar punctatus; pronoto cristato, post-scutello bimamillari; metathorace valde excavato, superne acute marginato; 20 segmento postice clunium duarum instar turgente, margine profundissime canaliculato et maxime

reflexo; macula frontali et subalari, tegulis, maculis 2 scutelli et 2 metanoti, pronoti abdominisque segmentorum 1^a-4^a margine, tibiis et tarsis, pallide-flavis.—♂. Clypeo polygonali flavo; scapo subtus flavo.

Odyn. cluniculus SAUSS. Revue et Mag. de Zool. XXII, 1870, 60, 18, ♂.

♂. Total length, 9 mm.; wing, 7.5 mm.

Body cribose, with very large, deep punctures; head rugose, sharply margined behind. Prothorax anteriorly crested, angulate. Post-scutel bearing a sort of emarginate crest or two bidentate eminences; its hinder face elevated, flattened; metathorax vertically truncate, much excavated, rather polished, very sharply margined superiorly by two angulate prominent ridges, separated by a sort of channel, being the continuation of the ground of the cavity; the superior cheeks rather separated from post-scutel by a sulcosity, and having a polished space; the inferior part rather angulate inferiorly, but the angles quite rounded; the *inferior* edges nearly horizontal. Abdomen quite deformed. First segment short, truncate anteriorly; its transverse edge blunt, although a little salient because of a depression of the superior face. Second segment slightly ovate; quite swelled above into two large, salient, rounded tubercles, separated by a deep excavation, resembling two brushes; the margin forming a rather broad, extremely deep channel, with the posterior edge reflexed into a very much elevated crest, slightly undulating in the middle. Third segment cut a little concavely behind. The first three segments quite as strongly cribose with enormous punctures as the thorax (also the tubercles of the 2d segment). Those following not as strongly punctured.

Black. A frontal and post-ocular spot, anterior margin of prothorax, a macula under the wing, tegulæ, two spots on the scutel, two spots on the metathorax and its blunt angles, and the margins of the first four abd. segments, pale yellow; margins of 1, 2 segments moderate; 3, 4 very narrow. Feet black or brown; knees, tibiæ, tarsi, and coxæ 2, 3, pale yellow; tibiæ rather ferruginous. Wings subhyaline, anterior margin narrowly brown.

♂. Clypeus polygonal, as wide as long, coarsely punctured, truncate, pale-yellow, as well as a line on the scape of the antennæ; hook ferruginous.—♀?

Rees. a. diff.—A species quite distinct by the unusual form of

its abdomen, recalling, with exaggeration, the African *O. canaliculatus*.

Hab. The temperate part of Mexico. Orizaba (1 ♂, Sumichrast).

- B. *Metathorax triangular, narrowed posteriorly, not so much excavated, with sharp superior ridges. Post-scutel not crested. Second abdominal segment channelled and reflexed, scarcely swollen.*

111. *O. Morelii* SAUSS.—Niger, dense punctulatus, fulvo-tomentosus; pronoto angulato; metathorace haud angulato, foveola postica canthis acutis superne marginata; abdominis primo segmento minore, margine elevato; secundi margine rugoso, valde canaliculato valde reflexo; antennis basi ferrugineis; ore, orbitis et verticis fascia arcuata, pronoto, macula subalari, tegulis, scutelli margine, metanoti canthis, pedibus abdomineque, ferrugineis; segmentorum margine obscure flavo; segmentis 1^o, 2^o basi nigris; alis dilute infuscatis, in costa ferruginea.—♂. Clypeo rotundato, transverso, flavo; argenteo-tomentoso; vertice tuberculo polito obsoleto instructo.—♂.

Odyn. Morelos SAUSS. Rev. et Mag. de Zool. IX, 1857, 276, ♂.

Total length, ♀, 12 mm.; wing, ♂, 10 mm.

♂. Head rather swelled transversely at the occiput or behind the eyes. Vertex a little hollowed, or with a double, polished low tubercle behind the ocellæ, and between this and the ocellæ, a sort of arcuate depression, often obsolete. Thorax short; prothorax quite squarely cut, its angles sharp, but not produced. Post-scutel quite shortly truncate, linear, transverse, insensibly depressed in the middle; but not edged nor crenulate; its hinder face elevated. Metathorax rather narrow; its upper face on each side convex; its hinder face rather triangular, forming each side almost a blunt lateral angle; the excavation margined superiorly on each side under the post-scutel by a sharp arcade or arcuated edges, very salient, like a sharp crest, but not erect, forming no teeth whatever behind the post-scutel. Abdomen constricted at base of the second segment; the first segment very small, much narrower than the second, truncate and rounded at base; its margin a little edged. The second segment very strongly canaliculate along its margin; the channel widened in the middle and

the segment slightly swelled into two little cheeks before the channel; the edge strongly reflexed; the edge of the 3d also a little reflexed; the 2d beneath as tuberculate at base. The whole insect finely and densely punctured, on the abdomen as well as on the thorax; more coarsely on the margin of 2-4 segments. The body woolly, furnished with gray-fulvous hair.

Black. Mandibles, the 2-3 first joints of antennæ, a frontal longitudinal line, an elongate large post-ocular spot, not touching the eyes, and an angulate line on the vertex parted by the tubercle, and continuing along the inner orbits of the eyes, rufous. Prothorax, tegulæ, a spot under the wing, post-scutel, hinder part of scutel, and often the angles of metathorax, rufous. Abdomen rufous; the base of the first two segments black, and the margin of all segments yellowish. The black of the base is often prolonged on the middle of the segment. Feet rufous. Wings smoky, with the anterior edge ferruginous.

♂. Clypeus wider than long, fulvous or yellowish, with argenteous reflections, although having some black hair; its inferior margin rounded, with a little notch and bidentate in the middle. Hook of the antennæ large, arcuate, black

Var. a. The head not much variegated with ferruginous. Orbits and vertex nearly black. A black spot near the edge of the 2d abd. segment.

b. Metathorax black.

Res. a. diff.—The coloring of this insect is what I should like to call the Mexican livery; this dull ferruginous fulvo-velutinous livery being quite a Mexican type. This coloration is quite that of *Ancistrocerus tuberculiceps*, and much also that of *Odynerus Guerreri*. From this it differs, by its abdomen, not conical, the first segment being much narrower than the 2d; by the margin of the 1st segment which is hemmed, and that of the second, much more canaliculate; by its post-scutel not sharp nor crenulate, and by its very large, wide clypeus.

This is quite an exceptional type by the form of its abdomen, post-scutel, and its wide ♂ clypeus.

Hab. The temperate parts of Mexico. I caught two males in the fine valley of Mexutilan.

Division STENODYNERUS.

(SACCH. Vespides I, Divis. IV, 206.—III, Divis. Epsilon, II^e Sect., p. 255.
Stenodynerus, Melang. Hymenopt. II^e fasc., p. 58.)

Body elongate, generally slender; often cylindrical. Abdomen slender and cylindrical, or ovate, not quite sessile, or spindle-shaped, subpedunculate. Its first segment variable, having the shape of rather an elongate bell, rounded anteriorly or cup-shaped, subpedunculate, or funnel-shaped, often longer than wide.—Post-scutel generally entire, not truncate, angular posteriorly; but yet sometimes truncate when the abdomen is spindle-shaped and subpedunculate.

This is a type very richly represented in America.

The *Odyneri* of this division constitute a special type, remarkable by the elongation of their forms, which is among the *Odyneri*, quite a corresponding similarity between the *Stenancistrocerus* and the *Ancistrocerus*.

The parallelism is so complete that one may even designate in both groups some corresponding species of which some are quite approximate, merely differing by the presence or absence of a suture on the 1st abdominal segment,¹ others very analogous,² although not quite so similar. This very difficult group is not distinguished by any one special character, but by the combination of several, which are not all general to all the species, each species uniting only a certain portion of them, which partly occur in other *Odyneri*, but are combined in other ways. This makes the *Stenodyneri* very difficult to recognize, for one not very familiar with the genus *Odynerus*.

-
- ¹ *O. conformis.* *A. fulvipes.*
 O. vagus. { *A. sæcularis.*
 A. Bravo.

- ² a. *Abdomen elongate, cylindrical.*
 O. Enyo. *A. histrio.*
 O. totonacus. *A. Mexicanus.*
 b. *Abdomen more ovate; 1st segment cup-shaped.*
 O. speciosus. *A. militaris.*
 O. Peyroti. *A. Sumichrasti.*
 c. *Metathorax produced posteriorly; wings black, ornaments white.*
 O. luctuosus. *A. quadrisectus, etc.*

The difficulty in distinguishing the *Stenodynerus* from the *Pachodynerus* and the true *Odynerus* obliges us to make a review of the characters which are peculiar to each.

The clypeus is not characteristic in any. Generally pyriform, truncate, and biangulate at tip; in ♀ sometimes rounded; in ♂ polygonal-truncate and bidentate.

The thorax is cylindrical when the abdomen is elongate-cylindrical, vaulted above, anteriorly not contracted, biangulate (*O. conformis*, *toltecus*, *perennis*, etc.). When the abdomen is more ovate or spindle-shaped, the thorax is not so elongate, more triangular, contracted behind. It is nearly always more or less coarsely punctured, the metathorax being less strongly punctured.

The *post-scutel* is very peculiar. It has two different forms:

1st. Not truncate; that is, angulate behind, not forming a superior transverse punctate face and a posterior vertical polished face, but on the contrary entire; rather horizontal or oblique, falling into the hinder face of metathorax, more elevated anteriorly than posteriorly, as if it had been a little squeezed from behind forwards, so as to accumulate it somewhat along the anterior margin; when crested, the crest is placed on this elevated part near the anterior margin, and not, as in the *Divis. Odynerus*, on the posterior edge formed by the truncation. When not truncate, it is punctured on its whole surface.

2d. Truncate posteriorly and crested on the ridge of the truncation, nearly as in *Divis. Odynerus*. But in this case the truncation is more oblique, as if impressed from behind, and the crest rather pushed forward against the anterior margin. The truncation also is not as straight transversely, but is rather arcuate. In case the scutel is truncate, the *Stenodynerus* are yet quite distinct from *Divis. Odynerus*, in having the metathorax quite convex, not widely excavated, so that the posterior face of the post-scutel does not, as in *Odynerus*, make a part of the posterior concavity of the metathorax, and besides, the abdomen is quite slender, spindle-shaped, the first segment being funnel-shaped, rather pediculate, not wide and sessile as in the *Divis. Odynerus*.

The *metathorax* is quite variable. 1st. Sometimes produced horizontally, further than the post-scutel, including it behind (*O. luctuosus*), as in some *Ancistrocerus* (*A. 4-sectus*). 2d. Generally not produced superiorly, but somewhat produced under the

scutel before it becomes truncate, which is such that the post-scutel is not touched by the truncation; quite rounded, without lateral angles, with a rounded, free, not limited fossette; sometimes produced triangularly, convex, only parted by a longitudinal or sulcate channel. 3d. Truncate or biangulate, with a very sharp cavity and lateral angles (*O. spinifer*), but the post-scutel not truncate. Even when quite rounded posteriorly, the metathorax does not lose its lateral ridges, which extend from the posterior wing to the articular valves of the abdomen, and which must not be confounded with the superior and inferior edges which constitute the lateral margin of the concavity, when existing.

The abdomen has also various forms: 1st. In the elongate-cylindrical type it is elongate and cylindrical, sessile, but the first segment is bell-shaped, elongate, rounded, not or but slightly contracted anteriorly, but not truncate; as long as wide. This form is very different from that of *Divis. Odynerus*, where the 1st segment is wide, truncate anteriorly, its superior face being always wider than long. 2d. Elongate, slender, but more depressed; the 1st segment short, truncate, as in *Odynerus*, but the post-scutel not truncate (*O. spinifer*). 3d. More ovate, contracted anteriorly, the first segment being small, cup-shaped, rounded, not quite sessile, often subpetiolate; the 2d segment more swelled. 4th. Elongate spindle-shaped, quite slender, attenuated anteriorly the same as posteriorly; the first segment funnel-shaped, sometimes elongate and subpetiolate.

The abdomen has a tendency to be more produced than in *Divis. Odynerus*; and the 1st segment is always more coarsely punctured than the 2d, which is just the contrary in *Divis. Odynerus*. These various forms make quite insensible transitions from one to another, and their various combinations make it very difficult to define the subdivisions of the group, so that one must pardon me if I have not succeeded in rendering them distinct enough.

The table of species, based on empirical characters, will perhaps help the reader out of the chaos of the very numerous species, better than the diagnosis of the subdivisions, and the following table will assist in distinguishing the *Stenodynerus* from the *Divis. Pachodynerus* and *Odynerus* pr. dict.

- A. Upper face of thorax prolonged beyond the post-scutel, involving it behind. *Stenodynerus.*
- B. Thorax not prolonged superiorly behind the post scutel.
- a. Post-scutel entire, angulate behind. *Stenodynerus.*
- b. Post-scutel truncate posteriorly, having a posterior face.
- † First abdominal segment short, truncate anteriorly, its superior face wider than long. *Odynerus.*
- †† First abd. segment subpedunculate, funnel-shaped or cup-shaped. *Stenodynerus.*
- C. Abdomen thick, conical, widest anteriorly. *Odynerus.*
- D. Abdomen not so conical.
- a. First segment truncate anteriorly.
- a. Its superior face wider than long.
- * Post-scutel truncate; abdomen ovate-conical. *Odynerus.*
- ** Post-scutel not truncate; abdomen slender 1st segment more punctured than the 2d. *Stenodynerus.*
- β. Its superior face about as long as wide. *Stenodynerus.*
- b. Abdomen slender, cylindrical; first segment bell-shaped, sessile, rounded anteriorly, as long as wide. *Stenodynerus.*
- c. Abdomen more ovate, first segment smaller, cup-shaped. *Stenodynerus.*
- d. Abdomen slender, spindle-shaped; first segment funnel-shaped. *Stenodynerus.*
- E. First abd. segment less punctured than the 2d, or equally punctured with it. *Odynerus.*
- F. First abd. segment more punctured than the 2d or equally with it. *Stenodynerus.*
- G. Post-scutel entire, angulate behind. *Stenodynerus.*
- H. Post-scutel truncate posteriorly.
- a. Abdomen sessile, or subsessile, truncate at base. *Odynerus.*
- b. Abdomen subpedunculate, 1st segment funnel-shaped. *Stenodynerus.*

It is almost superfluous to say that these distinctions are not mathematical, nature always forming transitions which oblige us to admit a certain latitude in the exceptions and in the meaning of the definitions.

Table to assist in the determination of the Stenodyneri.

- | | |
|---|------------------------|
| 1. Wings black, with violet iridescence. | 111. <i>luctuosus.</i> |
| 1, 1. Wings cloudy, ferruginous, or subhyaline. | |
| 2. A crest or two erect spines behind the post-scutel. | |
| 3. Metathorax strongly biangulate, and bidentate superiorly. | 112. <i>spinifer.</i> |
| 3, 3. Metathorax superiorly margined with a semicircular ridge. | 113. <i>araucanus.</i> |

- 2, 2. No erect spines on metathorax, behind the post-scutel.
3. Scutel, metathorax, and first segment orange, wings ferruginous, with the apex brown. 115. *Enyo*.
- 3, 3. Insect black, with yellow or luteous ornaments.
4. Post-scutel black, truncate or crested; scutel adorned with yellow. Small species very slender.
5. Metathorax unarmed.
6. Quite small; antennæ and pleuræ maculate. 149. *acolhuus*.
- 6, 6. Larger. Antennæ and pleuræ ♀ immaculate. 150. *zendalus*.
- 5, 5. Metathorax having superiorly two small tubercles; quite small species.
6. Tubercles large, dentiform; post-scutel truncate, not crested. 154. *trpanecus*.
- 6, 6. Tubercles small. Post-scutel crested.
7. Tubercles rounded, punctured; post-scutel crested anteriorly. 151. *nahuus*.
- 7, 7. Tubercles sharp, compressed, very small.
8. Post-scutel crested anteriorly. 152. *olmecus*.
- 8, 8. Post-scutel crested posteriorly. 153. *chichimecus*.
- 4, 4. Post-scutel triangular or not distinctly truncate, generally with a yellow fascia.
5. Scutel and post-scutel orange. 142. *columbaris*.
- 5, 5. Scutel always black.
6. Post-scutel crested, yellow. 124. *Xantianus*.
- 6, 6. Post-scutel not crested.
7. Post-scutel black.
8. Thorax quite black.
9. Only the first segment margined with yellow. 132. *Nortonianus*, var.
- 9, 9. Segments 2-5 margined with yellow. 140. *similis*.
- 8, 8. Thorax adorned with yellow.
9. Only the first segment margined with yellow. 132. *Nortonianus*.
- 9, 9. The first two segments adorned with yellow.
10. Second segment with two yellow spots. 132. *Nortonianus*.
- 10, 10. Second segment without yellow spot. 144. *coyotus*.
- 7, 7. Post-scutel adorned with yellow; the 2d segment margined with yellow.
8. Anterior margin of prothorax adorned with yellow, not its posterior margin.
9. Margin of 2d segment very strongly canaliculate and reflexed. 118. *toltecus*.
120. *Toas*.

- 9, 9. Margin of 2d segment not canaliculate, or only slightly reflexed.
10. Second abdominal segment with two free yellow spots.
11. First segment with two yellow spots.
12. The spots elongate or oblique fasciæ.
13. Smaller, very slender, cylindrical.
117. *conformis*.
- 13, 13. Larger, not slender. 116. *vagus*.
- 12, 12. The spots rounded, or small, or triangular.
13. Margin of 2d segment slightly reflexed.
121. } *collega*.
120. } *Tous*.
- 13, 13. Margin of 2d segment punctured, not sensibly reflexed. 119. *anormis*.
- 11, 11. First abdominal segment without yellow spots.
12. Post-scutel bipunctate with yellow.
132. *Nortonianus*.
- 12, 12. Post-scutel with a yellow band.
13. Margin of 2d segment slightly reflexed.
121. } *collega*.
120. } *Tous*.
- 13, 13. Margin of 2d segment not reflexed.
14. Ornaments rufous, feet rufous, body velutinous. 126. *propinquus*.
- 14, 14. Ornaments yellow or pale; feet black and yellow, or yellow.
15. Small; ornaments luteous.
125. *Kennicottianus*.
- 15, 15. Ornaments yellow.
16. Segments 1-4 margined with yellow. Abdomen ovate.
119. } *anormis*.
126. } *propinquus*, var.
- 16, 16. Segments 1, 2, 4 margined with yellow. Abdomen slender.
17. Body much variegated with orange-yellow; femora yellow.
122. *burcuensis*.
- 17, 17. Body passably variegated with sulphur-yellow; femora black.
123. *pedestris*.
- 10, 10. Second abd. segment without free yellow spots.
11. First abd. segment with two yellow spots or fasciæ.
12. With two oblique fasciæ.
116. *vagus*, var.

- 12, 12. With two free spots. 121. *collega*, var.
- 13. Fossette of metathorax rather angulate superiorly. 129. *Texensis*.
- 13, 13. Fossette of metathorax rounded. 121. *collega*, var.
- 11, 11. First and second segments without free yellow spots.
- 12. Only the first two abd. segments margined with yellow or luteous.
- 13. Tibiæ and tarsi quite yellow or ferruginous.
- 14. Rather large; margin of 2d segment reflexed. 121. *collega*, var.
- 14, 14. Smaller, slender; margin of 2d segment not reflexed.
- 15. Ornaments wide, deep yellow; 2d segment strongly punctate. 128. *perennis*.
- 15, 15. Ornaments narrow, pale sulphur-yellow; 2d segments finely punctate.
 - 145. { *Tucubayæ*, var.
 - 148. { *Mohicanus*.
 - 147. { *Huro*.
 - 136. { *Catlepellensis*.
- 13, 13. Tibiæ and tarsi black, or maculate with yellow or luteous.
- 14. Insect not very slender; ornaments yellow; abdomen ovate, margin of first segment wide, widened on each side; feet black. 135. *mystecus*.
- 14, 14. Insect slender.
- 15. Ornaments pale.
- 16. Abdomen truncate at base; metathorax superiorly margined by an arcuate crest. 138. *Araucanus*.
- 16, 16. Abd. spindle shaped; metathorax not crested superiorly. Yellow margins quite narrow.
 - 144. { *coyotus*, var
 - 146. { *pruinosis*.
 - 143. { *totonacus*, var.
- 15, 15. Ornaments yellow; first abd. segment rather sessile, square above, rugose. 131. *figulus*.
- 12, 12. More than two segments margined with yellow.
- 13. Segments 1, 2, 4 margined with yellow.

14. Metathorax rough, rather angulate; 5th segment margined with yellow.
129. *Texensis*, var.
- 14, 14. Metathorax rounded, rather rough; 5th segment not margined.
127. *Pennsylvanicus*.
- 13, 13. The third segment margined with yellow.
14. The following segments margined with yellow.
147. { *Huro*.
135. { *mystecus*.
- 14, 14. Segments 1-4 margined with yellow.
15. Margin of 2d segment rather reflexed.
121. *collega*, var.
- 15, 15. Margin of 2d segment not reflexed.
16. Only the segment 1-4 ♀, 1-5 ♂ margined with yellow.
17. Body elongate; abdomen cylindrical; metathorax depressed, flattened. 130. *fasciculatus*.
- 17, 17. Body not so slender; abdomen more ovate, contracted at base; metathorax short, rounded.
133. *Victorie*.
- 16, 16. All the segments margined with yellow.
17. Ornaments luteous; anus black.
125. { *Kennicottianus*.
134. { *Inca*.
- 17, 17. Ornaments yellow.
18. All the margins wide; anus yellow. 137. *mayus*.
- 18, 18. The last margins narrow; anus black. 133. { *Victoriae*.
134. { *Inca*.
- 8, 8. Posterior margin of prothorax adorned with yellow, and often also its anterior margin quite black.
9. A free spot on each side of the 2d abd. segment.
126. *propinquus*.
- 9, 9. No free spot on the 2d segment.
10. Quite slender; only the first two segments margined with pale sulphur-yellow.
11. Feet black; tibiae often maculate with yellow.
Small. 143. *totonacus*.
Very small. 144. *coyotus*.
- 11, 11. Tibiae and tarsi fulvous. 145. *Tucubayae*.
- 10, 10. Not so slender, abd. more ovate; all the segments margined with yellow.
11. Metathorax rugose, reticulately rugose or punctate.

12. Body fulvo-velutinous; prothorax and first segment posteriorly well margined with yellow; wings ferruginous on the anterior edge. 139. *otomitus*.
- 12, 12. Body argenteo-sericeus; prothorax and 1st segment very narrowly margined, or quite black; 2d segment widely margined; wings cloudy. 141. *Peyroti*.
- 11, 11. Metathorax punctate, not so rugose; wings smoky. 138. *huastecus*.

Description of the species.

- I. *Metathorax having its posterior plate superiorly terminated by two erect teeth, or by an erect crest.*
- A. *Metathorax not prolonged beyond the post-scutel, but truncate at its apex, posteriorly excavated, angulate on each side; the superior edges of the posterior plate terminating in two erect spines, which are separated from the post-scutel by deep fissures.*

This type establishes the passage from the true *Odynerus* to the *Stenodynerus*. The metathorax continue to be formed as in the *Odynerus* propr. dict., angular and sharp, but the post-scutel, instead of being transversely truncate and crested, advances angularly between the spines of metathorax, and is not sensibly truncate. The first abdominal segment is short and truncate anteriorly. The other characters are quite those of *Stenodynerus*: Head rounded and convex; body slender, rather cylindrical, the first abdominal segment more punctate than the rest of the abdomen.

112. O. spinifer SAUSS.—*Gracillimus, elongatus; clypeo piriformi, punctato, apice arcuato-truncato, biangulato. Caput, thorax et abdominis primum segmentum, tenuiter dense punctata. Thorax convexus, antice haud coarctatus, tenuiter cristato-marginatus; scutellis deplanatis; post-scutello trigonali, apice haud vel obsolete truncato; metanoto postice oblique excavato, canthis lateralibus valde acutis, utrinque dentem efficientibus; foveola strigata, rugosa; canthis inferis acutis, valvis articulationis latis; canthis superis obsolete, superne pone post-scutellum in spinas 2 erectas elongatas excurrentibus. Abdomen sub-velutinum; primo segmento brevi, latitudine fere secundo aequali, antice rotundato, truncato, superne per sulcum partito; secundo elongato;*

segmentis 2-6 tenuissime punctatis. Corpus nigrum; mandibularum apice, tegulis, tibiis tarsisque, ferrugineis; punctis 2 in summo clypeo, puncto frontali, puncto utrinque post-oculari, et altero in oculorum sinu, pronoti linea antica interrupta, macula subalari, puncto utrinque in metanoti dentibus lateralibus abdominisque segmentorum 1^a, 2^a fascia angusta, flavis vel luteis. Alis fusco-nebulosis; venis fuscis, tegulis flavo-punctatis ♀.—Longit. 10 mm.; alæ, 7.5 mm.

Odyn. spinifer SAUSS. *Revue et Mag. de Zool.* X, 1858, 168, ♀.

Res. a. diff.—In this species the distribution of the colors is very characteristic. The scutel and post-scutel continue black, although there is a yellow spot under the wing. The yellow spots are all quite small and the bands quite narrow. These ornaments are whitish on the head and thorax, more yellowish on the abdomen.

This *Odynerus* resembles *O. scutellaris* by its metathoracic erect spines, but the forms are quite different; the post-scutel is not transversely truncate; the abdomen is more cylindrical; and it is the 1st segment which is the most strongly punctate, just the contrary of what appears in *scutellaris*; the head is more rounded, more convex; the metathorax more excavated, but its concavity is smaller; the livery is quite different.

Hab. Brazil, Para.

B. *Metathorax truncate, excavated; superiorly margined by an arcuate ridge, rather crenulate, separated on each side from post-scutel by a fissure.*

113. *O. Araucanus* SAUSS.—Parvulus, niger, gracillimus, cribri instar punctatus; pronoto valde angulato; metanoto superne cristulato; linea scapi, puncto frontali et subalari, tegularum marginibus, litura angusta pronoti marginis antici et post-scutelli, nec non fasciis 2 abdominis, albidis. ♀.

Odyn. Araucanus SAUSS. *Reise. Oester. Fregatte, Novara. Hymenop.* 14, 13, fig. 8, ♀.

Total length, 8 mm.; wing, 5 mm.

♀. Small, slender, cylindrical; head and thorax densely punctate; abdomen rather more finely punctate. Head excavated posteriorly. Prothorax having its angles very sharp. Metathorax almost vertically truncate, rugose on its superior part; its hinder face much excavated; the excavation almost polished,

nearly forming on each side a sort of angle, acutely marginate superiorly in an arc of a circle; the margin rough, slightly elevated behind the post-scutel, crenulate, separated from post-scutel by a fissure. Abdomen cylindrical; the first segment rather elongate, anteriorly rounded-truncate.

Black, shining; mandibles, apex of the tarsi, and antennæ beneath, ferruginous; a line on the scape beneath, a frontal and post-ocular spot, anterior margin of prothorax, two spots on the margin of the tegulæ, post-tegulæ, one or two spots under the wings, a line on post-scutel, and the margin of the first two abdominal segments, luteous. Feet black. Wings subhyaline, the nerves brown.

Res. a. diff.—It much resembles *Ancistr. scabriusculus*, but is distinct by its abdomen, without suture.

Hab. Chili (Museum of Vienna).

C. *Form not very slender. Metathorax produced horizontally beyond the post-scutel; then vertically truncate; the post-scutel quite enveloped by it posteriorly, not reaching up to the edge of the posterior face of metathorax; the posterior face of metathorax superiorly terminating in an erect crest, parted by a fissure. Vertex in ♀ having two pilose tubercles.*

This type is in the *Stenodynerus*, the corresponding representative of the type of *A. 4-sectus*, in the *Stenancistrocerus*. It has also the metathorax prolonged and the vertex armed with two pilose tubercles. But the abdomen, although polished in the same way, is much contracted at base.

114. O. luctuosus SAUSS.—Validus, ater, rugosus, nigro pilosus; clypeus piriformis, paulum punctatus, apice paulum emarginatus, bidentatus. Caput et thorax crasse punctata, rugosissime secundum longitudinem elevato-strigata; vertice cirris 2 pilorum nigrorum instructo, pronoto cristato-marginato, angulato; scutello lævi, nitido, sparse punctato; post-scutello depresso, integro; metathorace rugosissimo, transverse elevato-striato, nec non utrinque subtus arcuato-strigato, velutino et longe nigro-vel cinereo-piloso, pone post-scutellum producto, dein truncato; postice tantum in medio foveolato, grosse strigato; sed in summo, supra foveolam in cristulam producto, transversam crenatam, in medio divisam. Abdomen nitidissimum, sparse punctatum; primo segmento basi truncato valde angustiore quam secundum; secundo supra in tuberculum tumescens.—Linea mandibularum, maculæ 2 laterales clypei, lineæ in antennarum scapo et maculæ

2 magnæ in basi secundi abdominis segmenti, albidæ. Alæ nigro-violaceæ.—Longit. 20 mm.; alæ, 17 mm.

Odynerus luctuosus SAUSS. Et. Vesp. III, 220, 114 (1854).

This *Odynerus* has many characters in common with the *O. 4-sectus*; tubercle of 2d segment (here much more developed); form of clypeus, brush of vertex, superior termination of metathorax; but it differs from it by the strong rugosities, by the form of the striæ of the head and thorax, and by its metathorax which offers no trace of latero-superior ridges, so that the lateral ridges are continued with the inferior ridges, in forming lateral trenchant, but not acute angles.

The first abdominal segment is a little funnel-shaped, truncate. The maxillary palpi have the 2d article long and slender, and the last three quite small, although longer taken together than the 3d.

The two spots of the abdomen might cause this *Odynerus* to be taken for the *O. bidens*, if its form and punctuation were not wholly different.

Hab. America. Which part, not known.

II. *Metathorax not forming erect spines or crests behind the post-scutel. Its superior face not produced behind the post-scutel. This last not posteriorly truncate, but angular. Post-scutel generally yellow, scutel usually black.*

The great number of species composing this group, and the intimate relations which they bear to each other, make me doubtful of my success in defining them with certainty.—The species are all of moderate or small size.

1. *Body slender, cylindrical. Concavity of the metathorax wide, sometimes rather distinctly limited. First abdominal segment bell-shaped, rather elongate, widely rounded anteriorly, sessile or subsessile. Thorax rather elongate, vaulted, subcylindrical.*

(Group of *O. conformis*.)

This group represents the true *Stenodynerus* with elongate, slender, cylindrical forms. Among the *Stenancistrocerus* this has quite a corresponding facies in the group of *A. fulvipes*, so that one may find it difficult to distinguish some of the corresponding

species of both series. Thus *O. vagus* seems nearly of a form with *A. fulvipes*, in which the suture of the first abd. segment should disappear.

A. Metathorax slightly prolonged under the post-scutel beyond it, being truncate before;¹ its concavity margined with sharp edges, nearly angulate on each side.

a. Abdomen slender, cylindrical; first segment as wide as the second. Body velvety.

115. *O. Enyo*—Gracilis, elongatus et angustus, omnino velutinus; clypeo ♀ piriformi, punctato, apice biangulato; capite et thorace grosse cribratis; pronoto biangulato; metanoto granuloso, pone post-scutellum foveolato-truncato; ejus foveola rotundata marginibus arcuatis, hebet atis punctatisque circumdata; canthis inferis utrinque dente duplice instructis; abdomine valde elongato, angusto; dense punctato et velutino; primo segmento magno, elongato, basi truncato, supra fere pariter longo quam lato, grosse cribrato et in longitudinem per canaliculum obsoletum partito.—Niger; ore, capite abdominisque segmentis 3-6, obscure ferrugineis; clypeo, thorace et abd. secundo segmento nigris; tegulis, post-scutello, metanoto, abdominis primo segmento et pedibus, aurantiis; antennis aurantiis; basi ferrugineis; alis flavis, parte apicali nigra. Longit. 12 mm.

♂. Minor; metanoti canthis paulo distinctioribus macula frontali et clypeo, flavis; hoc anguste polygonali, bidentato; antennis uncinatis, aurantiis.

Odyn. Enyo LEP. ST. FARG. Hymen. II, 648, 33 (1841).—SAUERS. Et. Vesp. I, 185, 81.—SAGRA'S Hist. de Cuba, Ins. 770.—CRESSON, Philad. Entom. Proceed. IV, 1865, 165.

Odyn. elegans GUÉR. Icon. Regn. Anim. Ins. 446, pl. 72, fig. 5 (1842).

Hab. Cuba.

B. Metathorax scarcely, or not distinctly produced under the post-scutel, beyond it.

a. Abdomen elongate, cylindrical, with the 1st segment as wide as the 2d, elongate; or ovoid-elongate with the 1st segment a little narrower, rounded.

* The 1st and 2d abdominal segments each adorned with two yellow spots, or fasciae beside their marginal fasciae.

(Observation.—These spots are often wanting, particularly in *O. toltecus*.)

¹ This type finds in the *Stenancistrocerus* its corresponding type in *Stenanc. histrio*.

116. *O. vagus* SACSS.—Elongatus, gracilis, punctatissimus; flavo-variegatus; abdominis segmentis 1-2, vel 1-4, flavo-limbatis; primo insuper fascia interrupta flava; secundo punctis 2 liberis flavis, margine subcanaliculato, crassius punctato, ♀.

Odyn. vagus SACSS. *Revue et Mag. de Zool.* IX, 1857, 277, ♀.

Total length, 11-12 mm.; wing, 9 mm.

♀. The whole insect coarsely punctured. Head wider than high. Clypeus pyriform, subbidentate. Prothorax slightly angulate. Metathorax not very rugose superiorly, presenting on each side of post-scutel a little flat place; its posterior face excavated, but the fossette not margined by ridges; the margins quite rounded and rugose. First abdominal segment rounded anteriorly, cribose with coarse punctures, which continue at some distance on the anterior face; 2d segment very little wider than the first, quite cribose with punctures, not quite so coarse as on the first segment, except on the margin, where they become just as coarse; the margin is also very slightly canaliculate. Beneath, the 2d and 3d segments are cribose with large punctures, which are variable or effaced.

Black. Antennæ black, with a yellow line on the scape. An arcuate line on the summit of clypeus, a macula at base of mandibles, a frontal spot, a spot on the sinus of the eyes, and a post-ocular line, yellow. Two spots on prothorax (or a submarginal interrupted bi-areolate band), a spot under the wing, tegulæ, and their appendix, a band on the post-scutel, and the edges of metathorax, bright yellow. The 3d-4th abdominal segments narrowly margined with yellow, the 2d more broadly; the 1st segment adorned in addition with two oblique lateral lines (or an interrupted transverse fascia on its middle, near the base), and the 2d with two lateral yellow or rufous spots. The margin of the first wider in the middle, narrower on the side.

Legs black; knees, tibiæ, and tarsi yellow or ferruginous. Wings subhyaline or smoky.

Var. a. Clypeus black, with two yellow dots on its summit and often two at its apex, or yellow, with a black triangle.

b. All the abdominal segments margined with yellow.

c. Only the first two segments margined with yellow.

d. The edge of 2d segment a little reflexed.

- e. The yellow maculæ of metathorax quite variable, forming two lines or four spots, or only marking the inferior edges.
- f. A yellow spot on the mesothorax before the scutel.
- g. Prothorax with a complete yellow margin or with four spots.
- h. The spots on the 2d segment very small (or wanting?).
- i. Ornaments passing into ferruginous.
- ♂. Unknown.

Revs. a. diff.—This species has quite the appearance of *Ancistrocerus fulvipes* and *sæcularis*, although without suture on the 1st segment. But these two species must not be taken as accidental varieties of the same. *O. vagus* has the thorax not so cylindrical, shorter, a little wider anteriorly, and in the middle, narrower behind; the 1st abdominal segment is more rounded, more depressed at base; the 2d segment is also a little wider, which makes the abdomen not so cylindrical; the whole insect is not so coarsely punctured in *vagus*, especially on the clypeus; and the 2d segment is more finely punctured than the 1st, while in *fulvipes* and *sæcularis*, the clypeus and 2d segments are generally as coarsely punctured as the rest, although there exist some differences in the various specimens. It greatly resembles *O. oculatus* in its livery, but the 1st abdominal segment is larger, with more elongate yellow lines, not spots, etc.—It approximates still more to *O. conformis* (Comp. this species).

Hab. United States, New York (E. Norton), Illinois (B. D. Walsh), Tennessee (E. F. Falconnet).

117. *O. conformis* SACSS.—*O. vago* simillimus, at minor, gracillior, magis cylindricus, crassius punctatus; clypeo ♀ crassissime cribrato-punctato, metanoto valde rugoso, primo abdominis segmento basi truncato, in cantho rugoso; 2^o segmento crassius punctato, margine rugosissimo, reflexo; niger, flavo-variegatus; clypeo flavo-4-punctato, vel fascia aut lineolis 2 flavis; abdominis segmentis 1^o, 2^o solis flavo-marginatis, 1^o utrinque insuper fascia obliqua, 2^o utrinque macula flava. ♀.

Odyn. conformis SACSS. Et. Vesp. III, 219, 112, ♀ var. (1854).

Total length, 10 mm.; wing, 7 mm.

♀. A species quite approximating to *O. vagus*, but smaller, more slender, more elongate, quite cylindrical, and the first abd. segment longer than wide. The punctures coarse; the ornaments nearly the same.—This species still more resembles the *O. fulvipes*; it has much of its elongate-cylindrical form and rugose

punctures, but the 1st abdominal segment has no suture and is smaller.

Head orbicular or even higher than wide; the antennæ inserted almost below its middle. Clypeus shining, very coarsely cribose. Head and thorax coarsely punctate; metathorax a little elongate, very rough; its concavity deep; the upper checks more convex and prominent than in *vagus*; the lateral ridges not so much pronounced. Abdomen elongate and cylindrical, very coarsely punctured, especially the edge of the 2d segment, which is rather strongly reflexed; the first segment truncate at base, not so much rounded as in *O. vagus*, forming a transverse rugose edge; the rugosities sometimes resembling a vestige of a suture.

The livery is just the same as in *O. vagus*, but the segments 3-5 of the abdomen have no yellow margin; the clypeus generally has two yellow lines near the top and the disk of metathorax a basal yellow spot. In the southern provinces the wings become rather cloudy.

♂. Unknown.

Res. a. diff.—This should be compared with *O. pedestris*, *perennis*, *Kennicotianus*, and *anormis*.

Hab. The United States, New York (E. Norton), Tennessee (Fuchs).

118. *O. Toltecus* SAUSS.—Niger, gracilis, cylindricus, crasse punctatus, fulvo-pictus; abdominis segmentis 1^o, 2^o flavo-limbatis, utrinque flavo-bipunctatis; secundi margine maxime canaliculato, maxime reflexo.—♂ vertice tuberculato.

Odyn. Toltecus SAUSS. *Revue et Mag. de Zool.* IX, 1857, 277.

Total length, 10 mm.; wing, 7 mm.

Form as in *O. vagus*. Body elongate, slender, and cylindrical.

Head orbicular. Clypeus finely punctured, pyriform, terminated by a very small edge. Thorax elongate, convex; prothorax slightly angulate; post-scutel slightly carinated transversely. Metathorax narrow, excavated; the cavity strongly punctured, margined inferiorly by two little converging carinæ; the edges rounded, not sharp superiorly. The upper lateral spine of the articulation elongate; the inferior one triangular on the margin of the articular cavity. Head, thorax, and first segment of the abdomen, cribose with coarse punctures; the following segments

more finely punctured. Abdomen cylindrical, the first segment in form of an elongate bell, as wide as the second, rounded anteriorly, with a feeble depression above; the second constricted at base; its posterior edge very deeply and suddenly canaliculate, with its margin very strongly reflexed, like an erect lamella; the very deep channel very coarsely punctured. The other segments finely punctured, not reflexed.

Black. A ferruginous spot at base of the antennæ; a frontal spot, a dot in the sinus of the eyes at a post-ocular spot, a submarginal fascia on the anterior edge of the prothorax, a spot under the wing, margin of tegulæ, a spot on mesothorax before the scutel, post-scutel, and inferior edges of metathorax, dull ferruginous or yellowish. The first two abdominal segments margined with a regular yellow band, and adorned near the base, each with two lateral yellow or ferruginous spots; the spots of the first segment a little oblique. Feet black; knees and tarsi beneath ferruginous, or yellowish. Wings subhyaline, nerves fuscous.

Var. a. Prothorax with only two yellow spots; disk of mesothorax not spotted.

b. The free spots of the 1st and 2d segments of the abdomen wanting.

♂. Smaller. Vertex having a large double tubercle; this is flattened and polished, parted by a groove. Clypeus polygonal, longer than wide, yellow, terminated by two acute teeth. Scape of antennæ beneath, inner orbits and frontal spot, yellow. Hook of the antennæ black. Mandibles with a yellow line. Second abdominal segment slightly swelled; the free spots of the first two segments often wanting in the small specimens, especially those of the 2d segment. Tibiæ and tarsi yellowish-ferruginous. Metathorax generally black, except the valves of the articulation.

Var. In small specimens the tubercles of the vertex are quite obsolete.—The males are sometimes very small. Length, 7 mm.; wing, 5 mm.

Rees. a. diff.—This species has intermediate forms between *O. vagus* and *O. conformis*; it is a little more elongate and slender than the first; a little less than the second. It is very neatly characterized by the strong difference of form of its 2d abd. segment, the edge of which is extraordinarily deeply and narrowly canaliculated as in no other species, except *Ancistrocerus Aristæ*;

the margin being quite a high crest. In *O. conformis* it is only slightly reflexed and a little canaliculated, but not making a sharp deep channel as in *O. Bravo*. The tubercle of the head of the males is also very characteristic. (We notice that such are found in other species with strong canaliculate 2d segment as *Ancistrocerus tuberculiceps*.)

Hub. The temperate Mexico. I caught 13 specimens in the valleys of the Sierra Madre and near Mexititlan.

119. *O. anormis* SAY.—Niger, valde punctatus, abdominis 2^o segmento satis elongato, margine fortius punctato; primo cupuliformi; capitis punctis, pronoti margine antico, tegulis, macula subalari, post-scutello, metanoti angulis, abdominis segmentorum limbo, nec non secundi maculis 2, flavis.—♂. Clypeo, mandibulis, antennis subtus, flavis.

*Eumenes anormis*¹ SAY, Long's 2d Exped. 1824, Append. 78 (II, 346, 3), ♀ (non ♂).—Say's Entomol. (LE CONTE), I, 234, 3 ♀ (non ♂).—SAUSS. Et. Vesp. I, 232; III, 340, 225.

Odyn. anormis SAY, Boston Journ. I, 1837, 387, 5.—Say's Entomol. (LE CONTE), II, 767, 5.

Rhynchium anorme SAUSS. Et. Vesp. III, 184.

Odyn. oculatus SAY, Boston Journ. I, 1837, 385, 2 ♂.—Say's Entomol. (LE CONTE), II, 766, 2.—SAUSS. Et. Vesp. I, 219, 113, ♂.—CRESSON Amer. Ent. Trans. I, 1867, 387, 23.

Odyn. persecutor SAUSS. Et. Vesp. III, 256, 133, pl. xiv, fig. 1, ♀² (1854).

Total length, 11 mm.; wing, 7½ mm.

Pronotum wide, its angles sharp; post-scutel not elevated; metathorax having its lateral ridges sharp, but its cavity not bordered by sharp edges, nor with well-defined limits. Abdomen *ovalo-conical*; its first segment cup-shaped, not so wide as the

¹ There can be no doubt, whatever, about the identity of this species with *O. oculatus* ♀, it being very well described by Say. He called it *anormis*, because it has not the form of *Eumenes*, and he only classed it in this genus because of the similar structure of its mouth, being unaware that these two genera are not to be separately distinguished by the mouth. And further he says (Bost. Journ.), "It is like the *Oculatus* Say." Besides, he took his female specimen for a male, which made him find some difference from *Oculatus*, which was described from a male.

² In some copies the antennæ have been painted all yellow, by mistake. The yellow color is only to be seen beneath when developed under the flagellum.

2d; it is longer than wide. The whole insect strongly punctured; the thorax roughly punctured; the edge of the 2d segment having a line of strong punctures beneath, as well as on the dorsal side.

Black; a spot on the forehead, inner border of the orbits, a dot behind each eye; an interrupted border on the anterior edge of prothorax, a spot under the wing, post-scutel, tegulæ, and post-tegulæ, and the ridges of metathorax, yellow; the tegulæ with a brown spot; all the segments of the abdomen bordered with yellow, the first fascia fused with a lateral spot; the 2d segment adorned on each side with a clear yellow spot; beneath black; feet black at base; knees, tibiæ, and tarsi yellow. Wings hyaline, nerves brown, with a brown cloud in the radial cell.

♂. Clypeus very slightly emarginate, yellow; mandibles and antennæ beneath, yellow. Femora and coxæ anteriorly yellow.

Res. a. diff.—Very closely allied to *O. conformis*, but not as cylindrical.—Compare also the following species.

Hab. North America. Baltimore, Ohio, New York, Connecticut (E. Norton), Illinois (B. D. Walsh), Missouri (Say), New Mexico.

120. *O. Toas* CRESSON.—Niger; clypei summi fascia, punctis capitis, scapi fascia, pronoti maculis 2, tegulis, macula subalari, post-scutello, maculis 2 metanoti, abdominis segmentorum limbo, nec non maculis 2 basalibus 2ⁱ et maculis 2 confluentibus primi, albidis; secundo segmento margine reflexo; pedibus rufis, genibus flavidis.

Odyn. Toas CRESSON, Amer. Ent. Trans. I, 1867, 381, 24.

Total length, 4 lin.

♀. Black, densely and deeply punctured; a lunate line at base of clypeus, spot at base of mandibles, another above insertion of antennæ, another in the emargination of eyes, and a short line on posterior orbits, pale yellowish-white; clypeus with longitudinal punctures, narrowed at tip, which is subemarginate; apical half of mandibles ferruginous; palpi pale; antennæ with the scape whitish on the outside; two transverse spots on prothorax, tegulæ, except a dusky medial dot, a large spot beneath and a small spot behind tegulæ, post-scutellum, and a transverse mark on each side of metathorax, pale yellowish-white; metathorax rugulose, truncate, and subexcavate behind. Apical margin of all the abdominal segments, except the last, yellowish (that on the basal segment confluent, with a lateral subtriangular spot; that on the second sinuous anteriorly), and sub-basal, transverse

spot on each side of second segment, pale yellowish-white; apical margin of latter segment reflexed; the second segment beneath, with a yellowish apical margin and the third with a lateral spot of the same color. Legs ferruginous; coxæ and part of trochanters, black; tips of femora and base of tibiæ, yellowish. Wings subhyaline, dusky along the costa, stigma and costal nerve reddish-brown.

♂. Clypeus, upper surface of mandibles, a line between antennæ, dilated and sub-bilobed above, and the anterior orbits, almost filling up the emargination, but not extending above it, yellowish-white; the clypeus smooth and emarginate at tip; the antennæ black above, the scape yellowish-white beneath, the flagellum fulvous beneath; the apical joint gradually thickened, the eleventh joint emarginate beneath; the next suddenly smaller, and the apical joint hooked and subacute; the lateral spots on first and second segments of abdomen smaller and more oblique; beneath, the third segment has an entire apical yellowish margin.

Res. a. diff.—This seems to be very closely allied to *O. anormis*, from which it differs by its pale, whitish ornaments, and the reflexed margin of 2d segment.

Hab. New Mexico. (Museum of the Am. Ent. Soc. of Philadelphia.)

I do not know this species, and I cannot be perfectly sure of having assigned it the right position.

121. *O. collega* SAUSS.—*O. anormi* affinis, at minor; differt insuper metanoti foveola punctata, velutina; marginibus rotundatis; clypeo ♂ latiore quam longiore, longe bidentato, dentibus spiniformibus, distantibus. Niger; clypeo (♂), puncto frontali et post-oculari, orbitis internis, scapo subtus, pronoti fascia minuta submarginali, post-scutello, abdominis segmentorum 1ⁱ, 2ⁱ margine punctoque minuto utrinque primi segmenti, flavis vel fulvis; mandibulis, tegulis pedibusque ferrugineis; alis infumatis, violascentibus, ♂.

Odyn. collega SAUSS. Rev. de Zool. XXII, 1870, 61, 21, ♂.

Total length, 12 mm.; wing, 8.5 mm.

♀. ?

♂. Quite approximating to *O. oculatus*. But the size is a little larger; ♂ as large as *O. anormis* ♀; the punctuation is stronger, as strong or stronger than in *anormis* ♀, except on the metathorax, which is less rugose, velutinous. The excavation

of metathorax small, rounded, with edges quite rounded as in *O. propinquus*. The 2d segment is shorter, with its marginal zone more coarsely punctured and the edge more reflexed.

The livery is the same, but the prothorax has a waved sub-marginal yellow or fulvous fascia; no spot under the wing; tegulæ ferruginous. Segments 1-2 margined with yellow; 3 and 4 very obsoletely tipped with fulvous; the first segment adorned with two very small lateral fulvous spots; the 2d without such spots. Feet ferruginous; at base black. Wings smoky, rather iridescent.

Clypeus (♂) transverse, wider than long, yellow, terminated by two long spines separated by a semicircular notch. Mandibles ferruginous, partly yellow.

Var.? Two small spots on the 2d segment.

Res. a. diff.—It has the same form of abdomen as in *O. Xantianus*, from which it differs by its 2d segment, more swelled, bell-shaped, with a little reflexed edge. It is larger than *O. pedestris*, *perennis*, etc., and is especially distinguished by the form of its clypeus, short and long-spined.

Hab. New England. Connecticut (E. Norton).

Observation.—We are in possession of a ♂ specimen nearly identical with the described type, having the first two segments adorned with very small lateral spots (probably liable to be wanting), but the clypeus is triangular, more elongate, terminated by two long spines separated by a narrower deep notch.—Is it another species? (New York).

*** Only the second abdominal segment adorned with two yellow spots which are often wanting, principally in the males.*

Observation.—As in the preceding species, the spots of first segment are often wanting, and one must compare also the species of Section *.

122. *O. bacuensis* SAUS. (Fig. 28, 28a.)—Niger, crasse-punctatus, flavo-multipictus; metanoto utrinque hand angulato, foveola crasse punctata, superne infra scutellum canthis angulatis acutis terminata; 2^o abd. segmento tenuiter punctato; clypeo, antenna basi, capitis maculis, pronoto antice, tegulis, macula subalari, post-scutello, metanoti lateribus, tegulis, pedibus, abdominis segmentorum 1ⁱ, 2ⁱ, 4ⁱ, 5ⁱ margine et ano, flavis; 2^o segmento insuper utrinque macula flava; alis subferrugineis apice nebulosis.

Odyn. bacu. SAUS. Et. Vesp. I, 185, 80 (1852).—*O. bacuensis* SAUS. Ibid. III, 232.—CHRISTEN, Hymen. of Cuba, Proc. Ent. Soc., Philad., IV, 1865, 64.

Total length, 9 mm.; wing, 6 mm.

Slender. Head and thorax coarsely cribose. Prothorax slightly contracted and angulate. Post-scutel short, having no ridge, but its posterior part receding backward making for it a sort of hinder face. Metathorax a little produced backward beneath the post-scutel and sharply truncate vertically. Its hinder face excavated, coarsely cribose; the concavity margined superiorly by an angulated edge under the post-scutel; no lateral angles.

First abdominal segment bell-shaped, anteriorly rounded-truncate, quite coarsely punctured, anteriorly roughened, reticulate; second segment very little wider than the first, shallowly and more finely punctured.

Black. Mandibles rufous. Antennæ orange; the scape yellow anteriorly, extremity of flagellum black. Clypeus, a triangle on the forehead, inner orbits of the eyes, and a macula behind them, yellow.

Antennæ yellow at base (probably black at tip?). Anterior part of metathorax yellow. First segment of the abdomen yellow above, with a tridentate black emargination. Second segment broadly margined with yellow and adorned with two free yellow spots. Segments 4, 5 above with an incomplete yellow fascia. Anus yellow. Feet yellow, or partly ferruginous, coxæ black or spotted with ferruginous. Wings washed with ferruginous; the apex cloudy; the radial cell with a brown cloud.

♀. Clypeus pyriform, its apex slightly truncate, excavated.

♂. Clypeus slightly bidentate, yellow; mandibles yellow.

Res. a. diff.—This much ornamented species is characterized by the peculiar form of its metathorax; its livery recalls various species of the Antilles: such as *O. spectabilis*, which is distinct by its strongly angulated metathorax; *Ancistrocerus Poeyi* and *obliquus*, both distinguished by the abdominal suture; *O. cubensis*, distinct by its conical abdomen, not slender cylindrical-ovate as in *O. bacuensis*, and by its metathorax truncate on the same plane with the post-scutel, etc.

Hab. Cuba. 1 ♀ sent to me by Dr. Gundlach.

123. *O. pedestris* SAUSS. (Fig. 22, 22a.)—*O. conformi* simillimus, at primo abdominis segmento minore, utrinque immaculato.

*Odyn. fuscipes*¹ SAUSS. Et. Vesp. I, 143, 28 (1852).

Odyn. pedestris SAUSS. Ibid. III, 143, 28, ♂ (1854).

Odyn. proximus SAUSS. Revue de Zool., IX, 1857, 274.

♀. Total length, 10 mm.; wing, 8 mm.

♂. Total length, 9 mm.; wing, 7 mm.

♀. Form as in *O. conformis*, or a little less elongate, but rather more lengthened than in *O. vagus*. Clypeus cribrate with large punctures. Head circular, strongly punctured, as is also the thorax; metathorax not so roughly punctured, velutinous; its concavity superiorly margined with rugosities. First abdominal segment strongly punctured, slightly elongate, becoming more rugose anteriorly. Second segment not as strongly punctured, elongate, constricted at base; its margin coarsely punctured, a little canaliculate.

Black, shining; scape beneath, a spot on the mandibles, a frontal dot, two spots or an arcuate line on the summit of the clypeus, a post-ocular spot and a spot in the sinus of the eyes, an interrupted band or two maculæ on the prothorax, a spot under the wing, another before the scutellum, post-scutellum, and inferior edges of metathorax, yellow. Tegulæ ferruginous, spotted with yellow. Abdominal segments 1-4 regularly margined with yellow; the 2d adorned with two separate yellow spots near the base. Knees, tibiae, and tarsi, yellow.

Var. a. No yellow spots on the disk of mesothorax.

b. Only the segments 1-2 margined with yellow; metathorax immaculate.

c. Segments 3-4 partly margined with yellow.

d. Metathorax more rounded.

e. Two very small free spots on the 1st segment.

♂. Clypeus polygonal, a little bidentate, as broad as long, yellow; inner orbits yellow. Hook of antennæ black. Disk of mesothorax and metathorax generally quite black. Margin of 2d segment often more reflexed.

Var. The tip of clypeus black; spots of the 2d segment very small.

Revis. a. diff.—This may be a mere variety of *O. conformis*?. The same size, same punctures, same livery, except the two oblique yellow lines of the first segment, which are wanting.

¹ This name had been previously employed by Herrich-Schæffer

Still I find a difference. 1st, in the form of the head, not so circular, a little broader, giving it another appearance; 2d, in the 1st abd. segment, evidently smaller, not so broad at its base, but a little more funnel-shaped, a little depressed, a little longer, not quite as sessile. This becomes very evident when the abdomen is bent downwards.¹ It is also not quite as wide as the 2d segment; this being longer than in *conformis* and a little constricted at base, to fit into the 1st segment.

These characters of the abdomen seem to me to indicate a species different from *O. conformis*, but which can only be distinguished by a very experienced eye.—I can only compare the females, the male of *O. conformis* being unknown to me. Compare *O. Pennsylvanicus*.

Hab. The United States. New York, 2 ♀, 3 ♂, taken by me. Connecticut, 9 ♀, 6 ♂ (E. Norton).

124. *O. Xanthianus* SAUSS. ♀.—Niger, clypeo punctato, thorace lævi, impunctato; metanoto solo rugoso; post-scutello transverse obtuse cristato; metathoracis foveola superne subacutè marginata; abdomine punctato; secundi segmenti linea marginali crasse punctata; tertio in medio ferrugineo punctato; reliquis tenuiter punctatis; scapo antice, puncto mandibularum, frontali, oculari et post-oculari, fasciæque arcuata in summo clypeo, maculis 2 obliquis pronoti, macula subalari, post-scutello, fasciis 2 metanoti, abdominis vittis 2, maculisque 2 parvulis lateralibus segmentorum 1^a, 2^a, flavis; pedibus rufis, luteo-maculatis, basi nigris; tegulis rufis, flavo-maculatis.

Odyn. Xanthianus SAUSS. *Revue de Zool.* XXII, 1870, 103, 22, ♀.

Total length, 11 mm.; wing, 7.5 mm.

♀. Size, form, livery nearly as in *O. anormis*, but differing from it by the following characters. Clypeus a little more coarsely punctured and more truncate. Thorax smooth, not sensibly punctured, except on the upper face of metathorax. Scutel parted by a groove. Post-scutel elevated into a sort of blunt crest, flattened behind (seen from behind the edge is arcuate or rather trapezoidal, nearly bi-mamillated). Metathorax having its superior face a little prolonged behind the post-scutel, including it on both sides; widely truncate; its hinder face or excava-

¹ This position is a quite indispensable condition for the good study of *Odynerus*, and should be given to all the specimens.

tion smooth or a little punctured, superiorly margined by (almost) an edge, making an M or W reversed.

Abdomen having its first segment more rounded, narrower and a little longer; the second short and more strangulated at base, to fit into the first, its hinder margin with a more simple line of punctures; the 2d segment as coarsely cribose in the middle as the edge of the 2d, but only in the middle.

The arcuate yellow fascia of clypeus wider; the maculæ of prothorax more approximate; tegulæ ferruginous, with two yellow spots; lateral spots of the 1st segment quite small or wanting; knees, tibiæ, and tarsi ferruginous, spotted with yellow. Segments 3, 4 very narrowly margined, the 5th black. Wings cloudy.

Res. a. diff.—This species is easy to distinguish by its not punctured thorax, and elevated post-scutel.

Hab. Lower California. Cape St. Lucas (T. Xantus).

125. *O. Kennicotianus* SAUSS.—Niger, nitidus, punctatus, *O. Pennsylvanico* affinis, at brevior; dense punctatus, metanoto et abd. primo segmento grosse punctatis; corpore albido-variegato; macula mandibularum, clypei, frontis et oculorum, linea in scapo, maculis 2 pronoti, 2 metanoti, 2 subalaribus, post-scutello, tegulis abdominisque segmentorum limbo, secundi puncto utrinque tibiisque, albidis ♀.

Odyn. Kennicotianus SAUSS. *Rev. de Zool.* XXII, 1870, 104, 23.

Total length, 8 mm.; wing, 6 mm.

A species allied to *O. pedestris*. A little smaller; forms the same; the prothorax also finely angulate, but the thorax shorter; the metathorax a little less retracted and more open, that is, its concavity is a little wider. Abdomen less lengthened, first segment shorter, cupuliform, the 2d as wide as long, a little more densely and finely punctured. The metathorax and the first segment shorter, cribose with large punctures, almost as in the *O. perennis*. Scutel divided by a longitudinal groove.

♀. Clypeus black. A spot at summit of mandibles, three dots or an arcuate line on summit of clypeus, a spot on the front, another in the sinus of the eyes and one behind their summit, a line on the scape of the antennæ, two spots on prothorax, one under the wing, post-scutel, tegulæ, and two spots on the summit of metathorax, whitish; all the segment of the abdomen adorned with a white border, wide and regular; the 2d ornamented with

two dots of this color on its sides. Tibiæ whitish, spotted with black behind. Wings transparent, nervures brown.

Var. No lateral spots on the 2d segment.

Res. a. diff.—This *Odynerus* differs from *O. pedestris* and *Pennsylvanicus*, by the coarse punctuation of first segment, etc.; from the *O. perennis*, by its thorax, shorter, less strongly punctured than the first segment, by its less elevated head, its less prolonged form, etc.; from the *O. texensis*, by its less angulate and less rugose metathorax; by its first segment more coarsely and more equally punctured throughout; by the 2d less strongly punctured, especially along its posterior border, etc.—From all by its whitish, not yellow ornaments.

Hab. United States. One ♀ taken in Illinois by Mr. Robert Kennicott.

126. *O. propinquus* SAUSS.—Gracilior, ubique dense punctatus, fulvo-velutinus, aurantio vel rufo variegatus; pronoto antice et postice rufo-limbato; macula subalari, tegulis, post-scutello, metanoti canthis, segmentorum limbo, macula utrinque in secundo segmento pedibusque rufis ♀.

Odyn. propinquus SAUSS. Revue de Zoolog. XXII, 1870, 104, 24, ♀.

Total length, 11 mm.; wing, 8 mm.

♀. Very similar to *O. oculatus*. Clypeus not so produced, more truncate, very coarsely punctured, very obsoletely bicarinate below and biangulate at tip. An impressed point on the vertex. Thorax a little narrower. Cavity of the metathorax rounded, smaller, punctured; its margins quite rounded. Abdomen more cylindrical, the 2d segment not much wider than the first, as in *O. vagus*. The whole insect densely and almost equally punctured; the second abdominal segment as strongly punctured as the 1st, and like the thorax, but its hinder margin and the 3d more coarsely punctured; the base of the 2d above subtuberculate.

Black, grayish-velutinous, with a rather fulvous, hairy clothing; head and metathorax with a grayish reflection. A spot on mandibles, a fascia on the top of the clypeus, a frontal spot, a dot on the sinus of the eye, and a post-ocular spot, orange or pale; antennæ black, joints 1-2 rufous, a little obscure above. Both edges of prothorax, the anterior with a wide bilobed interrupted fascia, the posterior with a narrow line, a spot under the

wing, post-scutel, ridges of metathorax, tegulæ, the margin of all the abdominal segments, and two free spots on the 2d segment, orange or brick-red; feet ferruginous; coxæ maculate with ferruginous. Wings a little smoky. The rufous margin of the second segment is wide and regular; that of the first fused on each side with a little spot; the fascia of the last segments sometimes pale or yellow.

Res. a. diff.—This species is noticeable for its velutinous body and rufous ornaments; by its 2d segment as strongly punctured as the 1st, and the thorax, with its margin not channelled, scarcely reflexed at all, which distinguishes it from *O. collega*. It differs from *O. Xantianus*, by its more cylindrical abdomen, its 2d segment not short, and post-scutel not elevated.

Hab. Mexico. I caught this species in the "tierras templadas," South of Mexico.

*** No free yellow spots on the first two abdominal segments.

Observation.—Compare also the Sections * and **, for the varieties destitute of spots which the reader may be inclined to confound with the species of this group.—Comp. principally *O. collega*, *O. Kennicottianus*, *toltecus*.

127. *O. Pennsylvanicus* SAUSS.—*O. pedestri* affinisissimus, gracillimus; niger, punctatus; fascia scapi, pronoti et abdominis segmentorum 1ⁱ, 2ⁱ, 4ⁱ margine, post-scutello maculaque subalari, tibiis tarsisque flavis; tegulis rufis.—♀. Clypeo bidentato flavo.

Odyn. Pennsylvanicus SAUSS. Et. Vesp. id., III, 257, 134 (1854).

♀. Total length, 9 mm.; wing, 7 mm.

♂. Total length, 8 mm.; wing, 6 mm.

Quite approximating to *O. pedestris*. The size a little smaller; but the same form, only more slender. Head orbicular. The punctures about the same, but the clypeus more finely punctured. The concavity of metathorax not margined superiorly by wrinkled rugosities; its summit sooner occupied by reticulate large punctures. The abdomen very slender, cylindrical; the 1st segment having the same form as in *O. proximus*, rather small, elongate, a little depressed, having often merely a vestige of a suture. The margin of the 2d coarsely punctured, but only narrowly sulcate, or not at all channelled, only slightly depressed.

♀. Black. Clypeus quite black. A spot on the mandibles, labrum, a line on the scape of the antennæ, a spot in the sinus of

the eye, a post-ocular dot, an interrupted fascia on the prothorax, a spot under the wing, post-scutel and margin of segments 1, 2, 4, tarsi, and tibiæ, yellow. Tegulæ ferruginous; wings subhyaline; nerves brown ferruginous; the radial cell smoky.

♂. Antennæ ferruginous beneath; clypeus punctured, polygonal, shortly bidentate, yellow.

Var. a. The yellow margin of the 4th segment incomplete.

b. Segments 5, 6 margined with yellow.

c. The 3d obsoletely margined.

d. Only two yellow dots on prothorax.

e. Wing scales ♂ black.

f. Anterior tibiæ maculate with black.

g. Ornaments ♂ luteous.

h. Clypeus ♂ black on its inferior part. Flagellum of the antennæ ♂ quite black. (Louisiana.)

Res. a. diff.—May be a variety of *O. pedestris*?

Hab. United States. New York, Illinois, Wisconsin, Louisiana.

128. *O. perennis* SAUSS. (Fig. 25.)—Sat minutus, niger, elongatus, gracilis, crassissime punctatus, secundo segmento angusto, elongato; corpore flavo-variegato; capite paene altiore quam latiore; metanoto et abdominis primo segmento grosse foraminato-punctatis; abdominis segmentis 10, 20 late flavo-marginatis.

Odyn. perennis SAUSS. *Revue Zool.*, IX, 1857, p. 277.

Total length, 9 mm.; wings, 7 mm.

Form almost precisely as in *O. pedestris*, but the body more coarsely punctured.

♀. Head a little higher than broad, not so densely, but more coarsely punctured. Punctures of clypeus larger. Those of thorax very coarse. Those of metathorax and the first abdominal segment still larger, very rough. Those of the top of metathorax somewhat reticular. First abd. segment not quite as wide as the 2d, rather depressed above. Second segment yet strongly punctured, but much less than the 1st segment; its margin more coarsely, but not so strongly punctured as the 1st segment, not canaliculate; its base rather constricted, making it seem almost tuberculate.

Black. A spot on mandibles, the top of clypeus, scape beneath, a frontal spot, a spot in the sinus of the eyes and a post-ocular dot, a wide marginal band on prothorax and on the

first two segments of the abdomen, post-scutel, a spot under the wing, knees, tibiæ, and tarsi, bright yellow (or rather orange). Wings a little smoky; tegulæ and their appendix yellow.

Var. Wing scale rufous.—Apex of clypeus ferruginous.

♂. A little smaller. Head as wide as high. Clypeus polygonal, longer than wide, bidentate, yellow; mandibles almost yellow. Antennæ ferruginous beneath; hook black. Intermediate coxæ yellow before; posterior coxæ margined with yellow on the inner border.

Res. a. diff.—Differs from *O. pedestris* by its wide yellow bands and by the absence of free yellow spots on the 2d segments; by its more rugose metathorax and 1st abd. segment.

Compare also *O. texensis* and *Kennicottianus*.

Hab. North America. Tennessee ♀, New York ♂.

129. *O. Texensis* SAUSS.—Sat minutus, gracilis, niger, grosse punctatus; metanoto subangulato, rugosissimo, puncto frontali et oculari, pronoti margine, post-scutello, macula subalari et præscutellari, tegulis, abdominis segmentorum 1, 2, 4, 5 limbo, tibiis tarsisque, flavis; abdominis primo segmento basin versus rugoso; secundo sat brevi. ♂.

Odyn. Texensis SAUSS. Rev. de Zool. XXII, 1870, 104, 25, ♂.

Total length, 9 mm.; wing, 6.5 mm.

♂. Quite approximate to *O. Pennsylvanicus*. Same size, but not quite so slender; the thorax a little shorter, but little attenuated posteriorly, more coarsely punctured. The form almost exactly as in *O. perennis*, but the lateral edges making nearly two blunt angles; the excavation rugose. Abdomen as in *perennis*, but more densely and not so coarsely punctured; the 2d segment shorter, not so constricted at base; its base flat above, not subtuberculate; its margin coarsely punctured, slightly margined, not canaliculate.

Black. A frontal spot, a spot in the sinus of the eyes, a post-ocular line, a bilobed fascia on the margin of prothorax, tegulæ, a spot under the wing, post-scutel, a spot on the disk of mesothorax, yellow. Abdominal segments all margined with yellow except the 3d. Knees, tibiæ, and tarsi yellow. Wings a little smoky.

♂. Antennæ fuscous beneath; the scape with a yellow line. Clypeus yellow; its teeth spiniform; mandibles, inner margin of the orbit, and of the posterior coxæ, yellow or luteous.

Res. a. diff.—This species resembles by its livery *O. Pennsylvanicus*, but it differs by its stronger punctures, its thorax and abdomen shorter; the former being more square behind. It is in the nearest relationship with *O. perennis*. It recalls also *Ancistrocerus Sumichrasti*.

Hub. Texas. · 1 ♂.

130. *O. fasciculatus* SAUSS.—Niger, gracilis, cylindricus, ubique dense punctatus; prothorace biangulato; metathorace transverse depresso-compresso, superne rugoso; canthis lateralibus acutis, lamellaribus; foveola rhomboidali; primo abdominis segmento secundo latitudine aequali; capitis maculis, scapo subtus, pronoti margine antico, tegulis, post-scutelli fascia, metathoracis canthis inferis, abd. segmentorum 10-40 margine, tibiis, tarsisque, flavis.—♂. Clypeo fascia arcuata et maculis 2 apicis, flavis.

Odyn. fasciculatus SAUSS. *Revue de Zoolog.* XXII, 1870, 104, 26, ♀.

Total length, 10.5 mm.; wing, 8 mm.

♀. Form slender and cylindrical. Head as high as wide; vertex with an angulate groove. Thorax elongate, convex, and cylindrical. Prothorax wide, its angles finely dentiform. Metathorax rather compressed transversely, somewhat lamellate on the sides, oblique and posteriorly produced. Its concavity not vertical, but oblique, wider than long, having somewhat of a lozenge form, scarcely strigose; not margined, limited superiorly by the rugosities of the upper face; its inferior edges compressed, continued with the lateral edges. Abdomen cylindric-depressed, the 1st segment as wide as the second; anteriorly truncate-rounded, the 2d elongate. Head, thorax, and abdomen densely punctured; the metathorax more rugose than the rest; the 1st segment a little more strongly punctured than the mesothorax; the 2d segment having its margin widely and very slightly canaliculate, and a little more coarsely punctured than the rest of the segment.

Black. A line on the mandibles and on the scape of the antennæ, a double frontal spot, a dot between the eyes and the antennæ, a post-ocular spot, a double spot occupying the anterior margin of prothorax, a little dot under the wing, tegulæ, a line on post-scutel, and inferior ridges of metathorax, golden-yellow; abd. segments 1-4 adorned with a yellow marginal band; the first two bands rather wide and regular, but having the anterior side rather lacerated; the 3d not so wide; the 4th narrower,

incomplete. Feet black. Knees, tibiae, and tarsi yellow. Wings subhyaline, nerves fusco-ferruginous.

♀. Clypeus broadly pyriform, black, with a superior fascia or two spots near the apex, yellow; the apex truncate, subdentate.

Var. Clypeus yellow, with a black spot.

Res. a. diff.—This species is particularly distinguished by the form of its metathorax, which recalls *O. conformis*, the thorax being elongate, convex-cylindric, the prothorax not contracted anteriorly. The abdomen has the first segment shorter, not as long as wide above, more as in *O. conformis*. It has some similarity to *O. perennis*, but it is larger; the 1st segment is as wide as the 2d, the body not so coarsely punctured, etc.

Hab. Cuba. ♀.

131. *O. figulus* SAUSS.—Niger, nitidus, gracillimus, pronoto subangulato; abd. 1^o segmento antice truncato, supra rugoso; capite, thorace et pedibus, luteo-signatis; pronoti et post-scutelli margine antico linea lutea; abdominis segmentis 1^a-2^a margine luteo; alis hyalinis, in costa subinfuscatis. ♀.

Odyn. figulus SAUSS. Et. Vesp. d., III, 247, 120 (1854).¹

Total length, 10 mm.; wing, 8 mm.

An insect having a slender, cylindrical, lengthened form.

♀. The clypeus is rugulose, pyriform, and seems to terminate in two sharp little teeth; but these are only marked out by a fossette on the border. The thorax is wide before, its anterior margin is straight bordered, and the angles are distinct; before these angles the prothorax is slightly retracted. The scutel is notched on each side by a fossette. The metathorax has its lateral ridges horizontal; it forms on each side an angle blunted by the meeting of long inferior ridges; the posterior plate is triangular, occupied entirely by the concavity, which is bordered on each side by the inferior ridges, while posteriorly they lose themselves in the rugosities of the summit. The abdomen is slender and shining; the first segment is truncated anteriorly, following a ridge quite distinctly; its superior face is very coarsely punctured before and behind, always rather less toward

¹ It is probably in consequence of a transposition, that this species is found placed l. c. in the division *Purodynerus*. I am not wholly sure of the place it should occupy, not having the type before me.

the posterior border. The border of 2d and following segments offers a very much weaker punctuation. The head and thorax are densely, but quite finely punctured. The abdomen does not offer any swelling at the base of 2d segment beneath.

Black; a dot on the mandibles, a frontal and post-ocular dot, scape beneath, anterior margin of prothorax, a spot under the wing; two dots on tegulae, post-scutel, a line on each side of metathorax below, and the margin of segments 1, 2, luteous; tibiae with a yellow line; femora 1, 2, spotted with yellow at the apex. Wings dusky, margined with gray.

Hab. Guadalupe. Collection of the Marquis of Spinola.

2. *Form less cylindrical, not much elongated, the thorax more crowded together, often short and wide anteriorly, contracted posteriorly. Metathorax more convex, rounded; its fossette generally small, but always distinct. Abdomen ovoid or irregular, the first segment narrower than the second, having no longer the shape of an elongate-bell, widened anteriorly, which receives the second segment, but is not truncate anteriorly, not having an anterior and a superior face, but the two faces lost in a continued curvature; this segment not as sessile; second segment more swelled than in the preceding, short and convex, contracted at base to fit into the first*

Insects in general strongly punctured; often velutinous.

(Group of *O. Huastecus*, *olomitus*, etc.)

The type of this group is not easily defined, because each species unites only a part of the characters above indicated, the group being composed of an agglomeration of very divergent species. Among the *Stenancistrocerus* this type is reproduced by a *A. Sumichrasti*, *Guzmani*, etc.

All the species are of small size; they seem to be very numerous in the southern part of the northern continent.

It becomes more difficult to distinguish the numerous little wasps, because the species are quite approximate to each other, and the character of their punctures and forms varies between certain limits, so that one can only feel sure about them, by

comparing numerous specimens. It seems nearly impossible to determine single specimens upon simple descriptions.

The details of form and livery upon which I have endeavored to build the subdivisions of the arrangement of the species, are of a very doubtful profit, because of the difficulty of defining them clearly, so that they must not be absolutely relied upon.

A. Form rather stouter, abdomen rather wide in the middle, but yet attenuated before. The fossette of the posterior face of metathorax rounded, always distinct. (Fossette of metathorax sometimes margined superiorly.)

a. Thorax but slightly adorned with yellow; (sometimes quite black, with a yellow spot under the wing); post-scutel quite black or adorned with two yellow dots.¹

132. O. Nortonianus SAUSS.—Niger; clypeo antice anguste producto, subbidentato; metanoto rugoso, foveola striata, marginibus punctatis, obtusis; abdomine ovato, primo segmento valde punctato, cupuliformi, basi subtruncato, sessili, secundo magis tenuiter punctato; puncto mandibulari, frontali, post-oculari, lineola in oculorum sinu, macula subalari, punctis 2 post-scutelli et abdominis, segmentorum 1^l, 2^l margine tenuiter, flavis; 2^o segmento utrinque flavo-punctato et partim flavo-marginato; genibus et tarsis ferrugineis; tibiis anticis flavis. ♀.

Var. a. Thorace omnino nigro, macula flava subalari.—b. Secundo abd. segmento haud flavo-marginato.

Odyn. Nortonianus SAUSS. Rev. de Zool. XVII, 1870, 105, 28, ♀.

Total length, 9 mm.; wings, 7 mm.

♀. Rather small. Clypeus somewhat triangular, rather narrowly produced and subbidentate. Prothorax somewhat angulated. Post-scutel short, forming on its anterior (or superior) part a rounded transverse carina, with a little insensible medial tubercle; its hinder face slightly convex. Metathorax rugose, punctured, quite rounded, its concavity strigose, not marginate. Head and thorax not very coarsely cribose. Abdomen cylindrical, ovoid; the first segment short, truncate, and rounded anteriorly, as cribose as the thorax, the 2d slightly constricted at base, more finely punctured, becoming more coarsely punctured on its hinder part.

¹ Comp. also *A. Peyroti*, var.

Black, shining. A little mark at base of mandibles, and of the scape, a frontal spot, a little line in the sinus of the eyes, a post-ocular dot, a spot under the wing, and a narrow marginal line on the first abd. segment, yellow; knees and tarsi ferruginous; anterior tibiæ yellow, especially anteriorly. Wings transparent.

Var. a. Black. A spot on the mandibles, scape beneath, frontal and post-ocular spot, a little line in the sinus of the eyes, and one on the summit of the clypeus, yellow; the two spots of prothorax quite narrow; a spot under the wing, only two quite small dots on the post-scutel, a narrow margin on the segments 1, 2 of the abdomen, and two free spots on the 2d segment, yellow. Feet black; knees yellow; tarsi ferruginous; anterior and intermediate tibiæ anteriorly yellow.

b. The margin of the 2d segment with only a small lateral yellow mark.

Res. a. diff.—This *Odynerus* is well characterized by its quite exceptional livery, the thorax being quite black, with a yellow spot under the wing. It slightly recalls the description of *O. Tisiphone*, but the post-scutel is not yellow, and the metathorax not ridged on its margin.

Hab. New England, Connecticut. Taken by E. Norton.

b. Anterior margin of prothorax adorned with yellow, but not the posterior margin; the yellow fascia often bilobed or interrupted. Fosselet of metathorax large, rather triangular, occupying nearly the whole width of the metathorax.

* Sometimes there are two little free spots on the 2d abdominal segments. (These very small spots are very often wanting, and do not constitute serious characters.)

133. O. Victorie SAUSS.—Niger, tenuiter dense punctatus; metanoti foveola parum excavata, marginibus inferis subacutis; corpore sericeo-sublanoso; puncto mandibularum, puncto frontali, oculari et post-oculari, scapo subtus, pronoti margine antico, macula subalari, post-scutello, metanoti canthis, abdominis segmentorum marginibus, tibiis et tarsis, flavis; tegulis rufis.—*Variat.* puncto mesonoti et puncto utrinque 2ⁱ segmenti, flavis.

♀. Clypeo crassius strigato-punctato in summo, fascia arcuata flava.—

♂. Clypeo flavo, bidentato; striga mandibularum et orbitis internis, flavis; metanoto sæpius immaculato.

Odyn. Victoria SAUSS. *Revue de Zoolog.*, IX, 1857, 279, ♀.

Total length, 10 mm.; wing, 8 mm.

♀. Form and size as in *O. anormis*, clypeus coarsely strigate-punctate. An impressed point behind the ocelli. Thorax shorter. Metathorax rather flattened behind; its concavity not distinctly strigate; the *lateral* and inferior edges sharp. The first segment of abdomen not so sessile, nor so short, more rounded, funnel-shaped or cup-shaped; the second constricted at base, to fit into the first. The whole insect finely punctured, more finely and more densely than in *O. anormis*; the 2d and 3d segment more strongly so than the first; the margin of second more coarsely cribose; its edge smooth, very slightly reflexed.

Black, silky, rather woolly. Ornaments of the body yellow, just the same as in *O. anormis*; but the lateral spots of the first two segments are quite small or wanting, and the marginal fascia of prothorax complete. Tegulæ rufous. Wings cloudy, principally in the radial cell.

Var. a. Extremity of clypeus with two yellow marks; 5th abd. segment not margined.

b. Ornaments and feet, except at base, ferruginous.

c. No yellow spots on the 2d segment.

♂. Clypeus yellow, bidentate; a line on the mandibles and inner orbits yellow. No spots on the 2d segment.

Var. Metathorax quite black.

Res. a. diff.—A very difficult species. Most resembles *O. Mayus*; differs from it by its more triangular posterior face of metathorax, somewhat larger size, antennæ not fulvous beneath, etc.—(Nevertheless it may be a variety of *O. mayus*.)

From *O. anormis* it differs by its velutinous body and its less cylindric thorax, wider anteriorly.

Hab. Mexico. I caught 2 ♀ in the mountains of Angangueo (Michoacan); 3 ♀ near Cuernavaca; ♀ in the barranca of Mex-titlan; 4 ♂, 4 ♂ from Orizaba (Sumichrast).

** No lateral yellow spot on the abdomen.¹

† Excavation of metathorax rather large.

134. *O. Inca* SAUSS.—Parvulus; niger, ubique æqualiter punctatus, metathorace rite foveolato, foveola punctata; capitis punctis, pronoti margine antico, macula subalari, tegnulis, post-scutello abdominisque

¹ Compare also *O. Victoria*, which is very often destitute of lateral yellow spots on the 2d segment of the abdomen.

segmentorum limbo, pallide-flavis; pedibus nigris, genibus, tibiis antice tarsisque subtus luteis.—♂. Clypeo emarginato, flavo; antennis subtus fulvis; scapi fascia flava; alis infumatis.

Odyg. Inca SAUSS. Rev. de Zool. XXII, 1870, 105, 29, ♀ ♂.

Total length, 7 mm.; wing, 5.5 mm.

♀. Small. Thorax convex, narrowed posteriorly, margined and angulate anteriorly. The whole insect densely and about equally punctured, the abdomen as well as the thorax. Metathorax velutinous, truncate a little behind the post-scutel, having a rather wide cavity, which is punctate, rather margined; the lateral ridges salient, forming nearly a blunt angle on each side. First abd. segment small, cup-shaped, slightly depressed above, its punctures not stronger than on the 2d; this is constricted at base, subtuberculate at base above, quite cribose; the punctures a little stronger behind than anteriorly.

Black, grayish-silky. A frontal and post-ocular spot, anterior margin of prothorax, a spot under the wing, tegulæ, a fascia on the post-scutel, and the margin of all the abdominal segments pale-sulphur yellow; the fasciæ of the segments 1-2 the widest. Anus black. Feet black; tibiæ, knees, 1, 2, and tarsi, pale yellow; tibiæ black behind; tarsi obscure above. Wings smoky.

♂. Clypeus polygonal-pyriform, notched and bidentate, pale yellow. Mandibles black. A little carina between the antennæ. Sinus of the eyes margined with yellow. Antennæ fulvous beneath; the scape yellow beneath; the hook fulvous.

Revs. a. diff.—This approaches the *O. Kennicottianus*, by its form and its pale ornaments, although not as pale; but the scutel is not parted by a groove, the metathorax not so rough; the first segment is smaller, not so coarsely punctured, and the 2d is as coarsely cribose as the first.

Hab. Peru (E. Norton. Taken by H. Edwards).

†† *Excavation of metathorax smaller and rounded.*

185. *O. Mystecus* SAUSS.—Niger, flavo-pictus; clypeo, thorace et 1^o abd. segmento crasse cribrato-punctatis; secundo segmento polito, sparse et magis tenuiter punctato, margine impresso et crasse punctato; capitis maculis, pronoti maculis 2, post-scutello abdominisque segmentorum 1^o-3^o margine, flavis; primi fascia latiore utrinque aucta, 2^a subrepanda, 3^a tenuissima, ♂ incompleta; pedibus nigris artubus subferrugineis.

gineis; clypeo ♂ flavo, apice nigro, bispinoso; alis subhyalinis, tegulis nigris flavo-bimaculatis.

Odyn. Mystecus SAUSS. *Revue de Zool.*, IX, 1857, 279.

Total length, 8 mm.; wing, 6 mm.

♀. Clypeus pyriform, very coarsely punctured, nearly reticulately rugose, prolonged into a sort of beak, subemarginate at tip. Head, thorax, and first abdominal segment densely and strongly punctured. Edge of prothorax finely ruptured, its angles subdentiform. Metathorax vertical, convex, very rugose, rather velutinous; its concavity very small; the rough superior faces prolonging themselves on the posterior side, leaving but little place for the concavity; the *lateral* edges sharp and hairy. Abdomen rather short; the first segment rounded, not short, bell-shaped, strongly cribose, rugose at base; 2d segment somewhat in the form of a hawk's bell, rather short, polished, and more finely punctured; its base a little constricted, although the 1st segment is but little *narrower* than the 2d; its margin having an impressed zone of coarse punctures; this zone having anteriorly an undulate form; 3d segment densely punctured.

Black, shining, not velutinous like *O. Huastecus*, *Mayus*, and other Mexican species, but garnished with a sericeous gray pile, rather argenteous on head and metathorax. Mandibles brown or rufous; there are often two yellow spots on the top of clypeus; a frontal spot, a spot in the sinus of the eyes, and a post-ocular line, yellow. Antennæ black; the scape below yellow. Two spots in the middle of prothorax, touching its posterior edge, a quite small spot under the wing (or none), post-scutel and ridges of metathorax, yellow; tegulæ brown, margined with ferruginous, maculate with yellow; the margin of the first the widest, fused on the side with a lateral spot, making it emarginate on each side; the yellow fascia of the second segment having two wide notches, or rather undulate, complete beneath; the 3d margin quite narrow. Feet black; knees and tarsi beneath rather ferruginous. Wings subhyaline, not ferruginous-brown.

♂. Hook of the antennæ ferruginous. Clypeus squarely polygonal, longer than wide, produced inferiorly triangularly, and terminated by two separating teeth or spines; its surface quite coarsely punctured, yellow, with its extremity black.

The spots of the head larger, the sinus of the eyes quite yellow.

The anterior edge of prothorax with a nearly complete submarginal yellow band; no spot under the wing; the yellow band of the 3d segment incomplete. The cavity of metathorax larger, more limited superiorly.

Var. ♂. Clypeus with its lower half black; metathorax black. Ornaments of the head pale.

Var. ♀ ♂. Flagellum slightly ferruginous beneath. Tegulae blackish; border of 3d segment wanting, or incomplete or complete.

Res. a. diff.—A small species, rather distinct by the very coarse punctures of the clypeus, the coloration of the male, the colors of abdomen and coarse punctures of the first segment, and its clothing more sericeous than velutinous. The coarse rugosities of metathorax must not cause it to be confused with *O. otomitus*; this is a velutinous insect not as small, with a different livery and more angulate metathorax.

Hab. Mexico. I caught 2 ♀, 3 ♂ near Cuautla, in the hot part of the province of Mexico, and 1 ♂ in the Mechoacan.

136. *O. Catepetlensis* SAUSS.—Minutus, niger, capite elevato; antennis inferius insertis; metathorace foveolato; mandibulis apice rufis; clypei apice, puncto frontali et post-oculari, maculis 2 pronoti, tegulis, puncto subalari post-scutelloque, flavis; abdomine valde punctato, segmentis 10, 20 flavo-limbatis; pedibus fulvis, basi nigris. Alis subhyalinis in costa fusco-ferruginescentibus.—Long. 9 mm.—♀. Antennis nigris.—♂. Clypeo paulum bidentato, flavo; mandibulis antice et scapo subtus flavis; flagello subtus ferrugineo.—*Variat. signaturis luteis.*

Odyn. Catepetlensis SAUSS. *Rt. Vesp.* III, 255, 132.

I did not find this species in Mexico, and have not seen it again since I described it. The type in Spinola's collection has been destroyed. It seems to approach closely to *O. mystecus*.

Hab. Mexico.

137. *O. mayus* SAUSS.—Niger, cinereo-sericens, flavo-multipictus; pronoto antice, post-scutelli fascia, abdominisque segmentorum marginibus, ochraceo-flavis; tibiis antice flavis; tegulis ferrugineis.—♀. Clypeo truncato, superne macula fulva.—♂. Clypeo bidentato, vel subbidentato, flavo; antennarum flagello subtus fulvo; pedibus partim flavis.

Odyn. Maya SAUSS. *Revue de Zool.* IX, 1857, 279.

♀. Total length, 9 mm.; wing, 6.8 mm.

♂. Total length, 8 mm.; wing, 6 mm.

♀. Clypeus rather bicarinate, polished, cribose, truncate at tip. On the vertex a small impression. Prothorax squarely cut, its angles not prominent. Metathorax rounded, punctured a little less than thorax; its cavity small, rounded, punctured. The *lateral* ridges argenteous. Abdomen ovate; nearly as strongly punctured as the thorax; the first segment cup-shaped, a little margined; the second rather wide, its margin having a wide zone of more coarse punctures; not channelled, its extreme edge very finely margined; the 3d and 4th rather strongly punctured.

Black, silky, with the metathorax argenteous. A spot on mandibles, a transverse spot on the summit of the clypeus, frontal, ocular and post-ocular dot, and scape beneath, yellow. Anterior margin of prothorax adorned with a moderately wide yellow fascia, sometimes narrowed on the sides, bilobate in the middle. A yellow fascia on post-scutel; wing scales ferruginous, margined with yellow. All the segments of the abdomen regularly margined with yellow (rather ochraceous); the first rather narrowly, the second very widely; anus yellow at the extremity. Feet black; wings subhyaline, nerves subferruginous, the apex somewhat smoky.

Var. Metathorax black, or with two lateral yellow lines.

♂. Clypeus pyriform, yellow, terminated by two little triangular teeth (sometimes blunted). A line on the mandibles and a vertical line between the antennæ, yellow. Flagellum of the antennæ fulvous beneath. Yellow margin of prothorax narrow. Metathorax a little more triangular. Second abd. segment not so widely margined. Knees, tibiæ, and tarsi yellow, obscure on their posterior face.

Var. Wing scales ferruginous.

Var. ♀ ♂.—*a.* Form narrow; anus black; margins of segments 3, 5, 6 narrow; anterior margin of prothorax narrow.

b. Metathorax quite black.

c. Margin of the abdominal segments wide; anus yellow (*O. Maya* Sauss).

d. A spot under the wing or no spot.

e. The abdomen blacker, with argenteous reflection; its yellow ornaments more golden.

Rees. a. diff.—It differs from *O. mystecus* by the livery of its abdomen; by its metathorax, not rough; by the yellow band of

1st segment not widened on the sides, but on the contrary narrowed; 2d segment without an impressed marginal band; clypeus ♀ not as coarsely punctured and bicarinate; size somewhat larger, etc.

From *O. Victorix* it is distinguished by its shorter form, and metathorax not so triangular, and antennæ of ♂ fulvous beneath.

Hab. Mexico. I caught several ♀ ♂ in the temperate terrace of Cuernavaca, near Yautepec; and in the valley of Mexitlan.

c. Posterior margin of prothorax, and often also the anterior margin bordered with yellow. (Insects often velvety.)

138. *O. Huastecus* SAUSS.—*Crassiusculus*, fulvo-velutinus, densissime punctatus, metanoto argentato, minus distincte punctato quam mesonotum; clypeo apice et superne fulvo-maculato; pronoti margine antico et postico, macula subalari, post-scutelli fascia, metanoti canthis abdominisque segmentorum limbo, fulvis; 2ⁱ segmenti margine et tertio grosse punctatis; tibiis antice fulvis; alis subfuscoescentibus, tegulis fulvo-marginatis.—♂. Clypeo ovato, flavo-bidentato; secundi abd. segmenti margine paulum reflexo.—*Variat.* ♀. Clypeo et metathorace nigris.—♂. Antennis subtus fulvis.

Odyn. Huastecus SAUSS. *Revue de Zool.*, IX, 1857, 278.

Odyn. sobrinus SAUSS., *Ibid.*, 278, ♂ (*var.*).

Total length, 11 mm.; wing, 8 mm.

The size of *O. anormis*. A little impression behind the ocelli. Clypeus triangular, pyriform, coarsely punctured, truncate and biangulate at tip. Prothorax upturned, subbiangulate. Head and thorax densely punctured, velutinous; metathorax smoother; its hinder face triangular; having a small concavity, finely strigate and punctured, not margined; superiorly terminated by a double arch, but not ridged. The *lateral* edges (extending from the hinder wing to the articulation of the abdomen), compressed and sharp, covered with shining silvery hair.

Abdomen ovoid; the first segment rather elongate, cup-shaped or rather shortly convex funnel-shaped; the 2d rather in form of a hawk's bell, constricted at base to fit into the first. The whole abdomen silky-velutinous with fulvous reflections, densely but a little less strongly punctured, than the thorax; the second segment not quite as strongly as the first; its margin coarsely punctured, with the edge very little reflexed; the 3d not quite so coarsely, the 4th finely, the 5th and 6th not at all punctured.

Black, fulvo-velutinous. The extremity of clypeus and a spot at its summit; a frontal and ocular spot, a post-ocular line, a line under the scape, fulvous-yellow; the anterior and posterior edge of prothorax narrowly bordered with the same color. A spot under the wing, edge of wing-scales, a line on post-scutel, and the edges of metathorax margined with fulvous; segments 1-5 of the abdomen regularly margined with fulvous-yellow; fasciæ of 1st and 2d segments broader; of the others narrow. Feet black; tibiæ yellow anteriorly; tarsi fuscous. Wings smoky.

Var. a. Last abdominal segments without yellow margin.

b. Ornaments of the body more yellow.

c. Clypeus truncate or subbidentate.

♂. Of the same size or smaller; not so much of fulvo-velutinous, head argenteous before. Clypeus ovate-polygonal, longer than wide, bidentate, argenteous-yellow. The hook of antennæ black. Inner orbits fulvous. Metathorax generally quite black. The margin of 2d abd. segment more reflexed, more or less canaliculate; its base above somewhat subtuberculate. *Var.* No spot under the wing. *Var. sobrinus* Sss.—Somewhat more slender. The ornaments of the body bright yellow; no spot under the wing. Metathorax quite black. The abdominal segments all well margined with yellow, the fasciæ of medium width.—♀. Clypeus black or with a yellow spot at its summit; antennæ black, the scape yellow beneath. Knees, tibiæ, and tarsi yellow; tibiæ blackish beneath.—♂. The flagellum of the antennæ orange beneath; knees, tibiæ, and tarsi yellow.

Rees. a. diff.—In livery and size this is just like *O. otomitus*, but differs by both margins of prothorax being bordered with yellow and its metathorax not rugose, but only finely punctured. It has, like this species, the anus often margined with yellow and the antennæ yellow beneath, but the wings are not ferruginous as in this species.

It resembles *O. propinquus*, but differs in having the prothorax shorter and the 2d segment too much swelled, with the margin more reflexed.—Compare also *O. Peyroti* which is a quite allied species, but with black feet and narrow borders of first segment, and a wide bordering on 2d segment.

O. Totonacus is a much more slender and naked species.

Hab. The temperate and elevated parts of Mexico. I caught

a ♂ in the valley of Mexico; and several other specimens in the temperate regions of Cuernavaca, of the Huasteca, and in the valley of Mexititlan.

Observation.—I have joined *O. sobrinus* with *O. Huastecus*, because new specimens seem to establish the transition between the two presumed species. Nevertheless, *O. sobrinus* has a somewhat different metathorax. It is extremely difficult to decide upon the species of these small Odyneri, all quite variable.

139. *O. Otomitus* SAUSS. (Fig. 21.)—*O. Huasteco* similis, paulo minor, argenteo-vel fulvo-velutinus; pronoto bidentato; metathorace maxime rugoso, valde foveolato; pronoti margine postico et angulis, fascia post-scutelli, tegulis, abdominis segmentorum limbo, ochraceis; macula subalari nulla; metanoto immaculato; tibiis fulvo-maculatis; alis ferrugineis, apice griseis.—♀. Clypeo truncato, nigro, in summo macula fulva.—♂. Clypeo bidentato, albido vel nivo; antennis subtus pallide fulvis.

Odyn. otomitus SAUSS. *Revue de Zool.*, IX, 1857, 278.

Total length, ♀, 9 mm.; wing, ♂, 7 mm.

Very similar to *O. Huastecus*; having the same appearance, and the same kind of livery; differing principally in the following characters.

♀. Size rather smaller. Clypeus less elongate, truncate at tip. The impression of the vertex more distinct. Angles of prothorax quite dentiform. Metathorax truncate; its hinder face occupied by a large and deep concavity, punctured and rugose, but not margined by sharp edges; the upper face of the metathorax and the edges of the excavation extremely rough, occupied by very large punctures, or rather by little reticulate dimples, which occupy the superior margin of the excavation. First abd. segment punctured, much like the head; the second densely punctured, and having on its posterior margin a little stronger zone of punctures, but this margin not canaliculate, nor reflexed; the 3d still rather strongly punctured; those following densely but not strongly punctured. The whole insect rather velutinous, clothed with grayish or fulvous pile. Metathorax argenteous. A spot or a band on the summit of the clypeus, a frontal spot, a line on the scape, a very little spot in the sinus of the eyes, and a spot or line behind their summit, dull yellow. Posterior margin of prothorax, its angles, and a line on post-scutel fulvous or dull yellow. Tegulæ ferruginous. No spot under the wing nor on the metathorax.

All the abdominal segments regularly margined with ochre-yellow; the *anal segment yellow* or margined with yellow. The fasciæ rather wide; the first being the narrowest. Feet black; tibiæ a little spotted with yellow, often yellow anteriorly; tarsi slightly ferruginous. Wings ferruginous with the extremity smoky.

Var. a. The body grayish-velutinous or fulvo-velutinous.

b. Clypeus quite black.

c. Angles of prothorax scarcely dentiform.

d. A little yellow marginal line on both sides of the lower part of the excavation of the metathorax.

e. Anus black.

δ. Clypeus rather pyriform-elongate, bidentate, white or luteous, as also the frontal spot and the inner orbit of the eyes. Antennæ beneath yellow or fulvous; the hook arcuate, black. The 7th abd. segment only, margined with yellow.

Var. a. Clypeus obtusely bidentate.

b. Anus not margined with yellow.

An examination of numerous specimens has shown notable differences in the form of metathorax: 1°. Sometimes it is quite widely excavated, the lateral parts forming very salient borders, or it is even rather angulate on each side. The strong rugosities form sometimes a sort of arched edge, margining the fossette superiorly; sometimes they have a tendency to delineate angular ridges margining the cavity, making this bipentagonal as in the true *Ancistrocerus* (*A. capra*, etc.).—2°. In other specimens the metathorax is not so angulate, nor so excavated; its side margins are not so produced, but it is more rounded; the fossette is smaller and rounded, more closed and confined by the rugosities. This is more frequent in the males.

These various forms greatly embarrassed me until I could compare numerous specimens. It is important to notice that the principal character of this species is the very rugose sculpture of the metathorax, its form being variable. It is still more rugose and excavated than in *O. mystecus*.

Reas. a. diff.—A distinct species, well characterized by its metathorax, as just indicated; by its bidentate prothorax, and the abundant yellow margination of the abdomen, and anus, often yellow.

In the male the antennæ, yellow beneath, recall the *O. Huas-*

tecus var., and *Peyroli*, which have the same livery, but not the rough metathorax, and differ also ♂ by the reflexed margin of its 2d segment and the first having both the margins of prothorax yellow.

(Compare with *O. mystecus*, which has also a rough metathorax.)

Hab. The hot and temperate parts of Mexico. I caught 5 ♀, 4 ♂ near Tampico, and in the temperate part of the province of Mexico, near Yauztepec.—Numerous specimens were caught by my companion, Mr. Sumichrast, in the Oriental Cordillera, Cordova, Orizaba, etc.

140. *O. similis* SMITH.—Niger, fulvo-velutinus; puncto frontali et clypei apicis, abdominisque segmentorum 2^o–6^o margine, flavis; alis in costa ferrugineis. ♀.

Olyn. similis SMITH, Cat. Brit. Mus. Vesp. 80, 202, ♀.

Total length, 4½ lines.

♀. Black, covered with ochraceous pubescence, and having also a clothing of changeable golden pile. Clypeus truncate at the apex; the lateral angles acute, subdentate. A yellow spot between the antennæ and another at the apex of the clypeus. Thorax slightly narrowed anteriorly and posteriorly; the anterior margin of the prothorax not raised or sharply truncate. Metathorax rounded at the sides and truncate posteriorly, and slightly concave. Abdomen: first segment much narrower than the second, strongly punctured; its apical border marginate; the apical border of the 2–5 segment with a broad yellow fascia, the apical segment yellow, with a black spot in the middle of its base; the fasciæ of the segments continued beneath. Wings hyaline; the anterior margin of the superior pair yellowish; nervures ferruginous.

Hab. Mexico.

This species by its golden velutinous clothing and ferruginous wings seems to approach very nearly to *O. otomilus*, and *mayus*, but differs by its quite black antennæ, thorax, first segment, and feet. This should separate it more from *O. Peyroli* var., although differing in several characters, this species having more argenteous pile, antennæ not quite black, etc.

141. O. Peyroti SAUSS.—Niger, argenteo-sericens, confertim punctatus; abdomine magis tenuiter punctato; pronoto bidentato, postice tenuiter fulvo limbato; scapi fascia, post-scutelli fascia abdominisque segmentorum 2^a-6^a marginibus late, ochraceis; primo segmento trigonali-cupuliformi, tenuiter fulvo-limbato; pedibus nigris, anticis antice flavis vel fulvis. — ♀. Clypeus superne macula flava, punctis capitis flavis. — ♂. Clypeo bidentato, orbitarum margine interno, luteis; antennis subtus fulvis.

Odgn. Peyroti SAUSS. *Revue de Zoologie*, IX, 1857, 278.

♂. Total length, 9 mm.; wing, 6.5 mm.

♀. Clypeus bicarinate. Thorax short. Angles of prothorax dentiform. Metathorax rounded; its concavity small, rounded, strigate-punctate. Head and thorax densely punctured; the metathorax more velutinous, not so strongly punctate. Abdomen not sessile; the first segment not truncate anteriorly, but triangularly rounded, cup-shaped, nearly funnel-shaped, about as wide as long. The second rather short, its margin more strongly punctured, the rest more finely punctured than the thorax; the first segment scarcely more strongly punctured than the 2d.

Black, grayish-silky, with a strong reflection on head and metathorax. A spot on the superior part of clypeus, a line under the scape, a frontal ocular and post-ocular spot, a very narrow line on the posterior margin of prothorax, and its angles, fulvous; a line on post-scutel, edges of metathorax, the narrow margin of the 1st abd. segment, and a broad one on the 2d-6th, ochre-yellow; anus black, or margined with yellow. Feet black, the anterior pair fulvous anteriorly. Wings hyaline, brown at the extremity, slightly ferruginous at base; nerves brown or ferruginous.

Var. a. Both edges of prothorax margined with yellow.

b. A yellow spot under the wing.

c. Anterior edge of prothorax black.

d. Metathorax immaculate.

e. Wings somewhat ferruginous.

♂. Clypeus longer than wide, bidentate, pale-yellow, argenteous. Antennæ black, fulvous beneath; the scape and inner orbits with a yellow line. Metathorax quite black. The first segment smaller, more triangular. The edge of the second segment a little reflexed.

Var. a. The first segment scarcely margined with fulvous.

b. No frontal nor post-ocular spots.

Res. a. diff.—This is a very difficult species. The yellow margin of the 2d segment is rather bi-emarginate as in *O. mystecus*.—The body is not fulvo-velutinous as in *Huastecus* and *Otomitus*, but more black, with silky argenteous reflections; the metathorax is not rough as in *Otomitus*, nor so widely excavated.—It differs also from *Huastecus*, by its acute prothoracic angles and smaller size, its deeper and more rounded metathoracic cavity, the yellow margins of abdomen, especially the 2d, wider; the 1st being much narrower, and its feet black. It can be easily distinguished by the wide margin of 2d segment. Sometimes, especially in the males, the head, prothorax, and first segment are almost wholly black.

Hab. Mexico. This was caught in the temperate district of Cuernavaca, south of Mexico, by my companion, H. Peyrot, to whom it is dedicated; ♀ ♂ also have been taken near Orizaba, 4 ♀, 2 ♂ (Sumichrast).

d. Prothorax quite yellow above. Scutel and post-scutel yellow.

142. *O. columbaris* SAUSS.—Niger; metathoracis foveola submarginata; abdominis 2ⁱ segmenti margine subreflexo; clypeo ♀ superne, puncto frontali, oculari et post-oculari, flavis; scapo subtus flavo; pronoto, macula subalari, scutello, post-scutello, metathoracis canthis, abdominis segmentorum limbo, tibiisque antice, flavis; alis subhyalinis, costa subferruginea, apice griseo; tegulis ferrugineis. ♀.

Olyn. columbaris SAUSS. Et. Vesp., I, 158, 42: pl. xvii, fig. 3 (1852).

Hab. South America; Columbia, (type in the Paris Museum.)

3. *Body elongate, slender; the abdomen especially, very slender.*

Metathorax convex, having no longer a distinct excavation, but sooner parted by a large groove, which separates its two cheeks, somewhat as in EUMENES. Abdomen slender, spindle-shaped; the first segment elongate, funnel-shaped, sometimes subpedunculate.

(Group of *O. Totonacus*.)

These insects are all small, shining, not velutinous; black, with luteous ornaments. They have quite the same appearance as those of Section III (see below), but the scutel is black, the prothorax has its *hinder* margin bordered with pale colors, and the post-scutel is not truncate.

(Among the *Stenancistroceri* this type is represented by *Stenanc. Fariasi*.)

143. O. Totonacus SAUSS. (Fig. 23.)—Sat minutus, gracilis, niger, nitidus, cinereo-subsericeus, cribrato-punctatus; metanoto convexo, tenuissime punctulato, foveola vel potius sulco striato diviso, canthis argenteo-pilosis; abdominis primo segmento convexo-infundibuliformi; capitis punctis, pronoti margine postico, post-scutello, metanoti fasciis 2, macula subalari segmentorumque 1ⁱ, 2ⁱ margine, sulfureis vel albidis¹; tibiis antice sulfureo-notatis; tegulis nigris.—♂. Antennis subtus ferrugineis; clypeo subemarginato, luteo, nigro-marginato.

Odyn. Totonacus SAUSS. *Revue de Zool.*, IX, 1857, 278.

Total length, 10 mm.; wing, 8 mm.

♀. Form slender, elongate, narrow. Head as high as wide; the notch of the eyes opened, triangular; clypeus rather strongly punctate, rather widely truncate, biangulate, or having a little concave apical margin. An impressed point on the vertex. Prothorax squarely cut, angulate, slightly bidentate. Head and thorax densely cribose; the flanks more finely punctate; metathorax narrowed, triangular, slightly biconvex, smooth, very finely punctured only, not cribose, like the rest of thorax; its excavation being rather a wide groove than a fossette; delicately strigate-punctate; the *lateral* ridges very sharp, garnished with whitish hair. Abdomen slender, elongate; first segment convex, triangular, cribose like the thorax; the second finely punctured, contracted at base or subtuberculate; its margin a little more coarsely punctured than the rest, but without a distinct zone, not canaliculate; the following less and less strongly punctured.

Black, shining, with sparse grayish down. Scape beneath fulvous; a spot on the mandibles, a frontal spot, ocular and post-ocular spot, pale yellow; posterior margin of prothorax and its angles, a spot under the wing, appendix of tegulæ, anterior margin of post-scutel, two elongate marks on the inferior extremity of metathorax, and a narrow margin on the 1, 2 abd. segments, pale sulphur-yellow; the yellow fascia of the second generally still narrower than that of the first; both a little prolonged on the lateral angles of the segments. Tegulæ black or margined with brown. Feet black; tibiæ anteriorly with a sulphur-yellow line; tarsi slightly brownish, or rather ferruginous. Wings smoky.

¹ Vel potius *stramineis*.

Var. a. Clypeus with a yellow spot at summit.

b. Head immaculate.

c. Angles of prothorax black; its posterior margin nearly all black.

d. Metathorax black; only the articular valves yellow.

e. The fascia of post-scutel interrupted.

f. Segments 3-5 narrowly margined with brown.

g. Tibiæ anteriorly obscure.

♂. Not quite as slender; thorax shorter. Second segment more tuberculate at base. Clypeus pyriform, truncate, its apical edge concave, hardly bidentate; its surface white, margined with black. Antennæ orange beneath; the scape luteous beneath. Mandibles immaculate; head often immaculate; metathorax but little maculate; coxæ 2-3 anteriorly luteous.

Var. a. The femora with a yellow line near the apex.

b. No spot under the wing.

c. Clypeus quite yellow.

d. Segments 3-6 narrowly margined with fulvous (only one specimen).

Var. ♀ ♂. Ornaments dull yellow (from alteration?).

Special Variety.—The margin of the second abdominal segment a little depressed or slightly canaliculate, more coarsely punctured, and even a little reflexed in ♂. In this variety the yellow margin of the 2d segment is as broad as that of the first. The anterior edge of prothorax is margined with yellow, and the posterior one incompletely margined. (♀ ♂, Orizaba.)

Res. a. diff.—A species distinct by its elongate slender form, its black shining body, cribose with punctures like fine strings, and smooth metathorax; as also by its scarce ornaments, straw-yellow and with only two abdominal fasciæ, the *hinder* margin of prothorax being bordered with yellow. It is very similar to *O. Tacubayæ*, but much larger, and more strongly punctured; the abdomen is not so elongate, the 2d segment is scarcely longer than broad, posteriorly truncate, not arcuate, etc.

144. *O. coyotus* SAUSS. (Fig. 26.)—Niger, minutus, abdomine gracili; corpore subrugose punctato; metanoto tenuissime punctato; abdominis segmentis 10, 20 valde punctatis; secundo basi constricto; scapo subtus, puncto frontali, oculari et post-oculari, pronoti margine antico et postico tenuissime, punctis 2 post-scutelli abdominisque segmentorum 11, 21

limbo anguste, sulfureis; tibiis antice tarsisque ferrugineis.—♂. Clypeo albido, apice submarginato; antennis subtus ferrugineis.

Odyn. coyotus SAUSS. Rev. de Zool. XXII, 1870, 106, 30, ♂.

Total length, 8 mm.; wing, 6 mm.

Form the same as in *O. totonacus*, but the size quite small as in *O. Tacubayæ*. Head and thorax very densely and rather rugosely punctured, shagreened; post-scutel triangular, but having at its summit a very delicate little arcuate sharp line; looking backward, metathorax not so oblique even as in *totonacus*, more vertical, not rugose, very finely punctured, convex, with a little fossette on its inferior part; its edges hairy, grayish. The superior articular valves of the apex spiniform. Abdomen slender; the first segment arcuate, funnel-shaped, longer than wide, very slightly petiolate, and with a depression above. Second segment about as wide as long, strongly constricted at base, which makes it subbidentate above and beneath. The first two segments almost equally punctured, as strongly as the thorax, but shining; the following less and less strongly so.

Black. The dots on the head nearly imperceptible or wanting; the hinder margin of prothorax and its angles quite finely bordered with pale yellow; only two little yellow dots on the extremities of post-scutel, and the first two segments with a narrow sulphur-yellow margin, which is not continued on the sides of the first segment. Feet black; tibiæ and tarsi somewhat varied with brown or ferruginous. Wings but very little smoky.

♂. Clypeus white, its extremity with an arcuate subemarginate notch. Mandibles with a white line. Flagellum fulvous beneath.

Res. a. diff.—This insect has just the same size and appearance as *O. acolhuus*, but yet is very different, having the post-scutel triangular, not flat above, truncate behind, not crenulate. From *O. Tacubayæ* it differs by its strongly punctured abdomen, and its shorter 2d segment, without an arcuate margin, shorter metathorax, etc.

Hab. Temperate Mexico. I caught two males in the valley of Mexititlan; one from Orizaba (Sumichrast).

145. *O. Tacubayæ* SAUSS. (Fig. 27.)—Minutus, niger, gracillimus, tenuiter punctatus, metanoto depresso, postice producto; abdominis 1^o segmento infundibuliformi: secundo valde elongato, margine postico arcuato; scapo subtus, frontis macula, pronoti marginibus, fascia post-scutelli et margine abdominis segmentorum 1^o-2^o, sulfureis; tibiis et

tarsis ferrugineis.—♂. Clypeo piriformi, nigro et flavo-variegato; flagello subtus fulvo.

Odyn. Tacubayæ SAUSS. *Revue de Zool.*, 1857, 279, ♂.

Total length, 8 mm.; wing, 6 mm.

Quite small. Form quite slender and elongate, particularly the abdomen, which is longer than head and thorax (♂), more elongate than in *O. totonacus*. Head and thorax finely cribrate; the former circular. Scutellum parted by a groove. Metathorax smooth, quite finely punctured, triangular, obliquely produced posteriorly, convex, rather flattened, parted superiorly by a groove, inferiorly having a very shallow flattened obsolete fossette; the lateral edges sharp, arcuate, clothed with argenteous pile. The articular valves of the apex not produced into long spines. Abdomen cylindrical; 1st segment convex-funnel-shaped, narrow, longer than wide, as strongly punctured as the thorax; having an obsolete transverse depression before its edge; 2d segment much longer than wide, constricted at base, sub-tuberculate above at base; its posterior margin arcuate, convex, having a line of stronger punctures; beneath near the base it has a sort of transverse wrinkle.

Black, shining, grayish-silky. Scape beneath, a spot on the forehead, a post-ocular spot, anterior and posterior edge of prothorax, a line on the post-scutellum, and inferior ridges of metathorax sulphur-yellow. Margin of the tegulae and a tubercle under the wing, ferruginous. Post-tegular appendix black. Articular valves of metathorax yellow. The first two abdominal segments narrowly margined with sulphur-yellow; the yellow margin of the first continued on the sides along the lateral edges of the segments (rather inferiorly); that of the 2d complete beneath. Feet black; tibiae and tarsi ferruginous. Wings very slightly smoky.

♂. Clypeus pyriform, rather bidentate, black, with two longitudinal yellow bands, or yellow, with a central irregular black band, and inferiorly margined with black. Scape of the antennae fulvous beneath; hook fulvous. Intermediate coxae spotted with yellow.

Var. Segments 3–6 margined with brown; the 3d beneath with a little yellow.

Res. a. diff.—Resembles *O. coyotus* and *tothonacus*, but not

as strongly punctured, and very distinct by its metathorax being more flattened and produced posteriorly, and by its long second abd. segment, with an arcuate edge. It is also much smaller than the last.

Hab. I caught only males in the valley of Mexico, near Tacubaya.

146. *O. pruinosus* SMITH.—Niger, sericens; capite, thorace et abd. 1^o segmento valde punctatis; fascia clypei summi, puncto frontali et post-oculari, pronoti margine antico, macula subalari, tegulis partim, post-scutello, metanoti canthis, abdominisque fasciis 2, albidis; pedibus 1^o, 2^o albido variis; alis subhyalinis. ♀.

Odyn. pruinosus SMITH, Cat. Brit. Mus., Vesp., 79, 200, ♀.

Length, 6 lin.

♀. Black; in certain lights, covered with fine silvery pile; the metathorax truncate, slightly concave, with a central impressed line, on each side of which it is obliquely striate; a stripe at the base of the clypeus, a minute spot between the antennæ, and another behind the eyes, white; the head, thorax, and base of the abdomen strongly punctured; the anterior margin of the prothorax, a spot beneath the wings, the anterior and posterior margins of the tegulæ, a spot behind them, the post-scutellum and lateral margins of metathorax, a spot on the apex of anterior femora behind, and the anterior and intermediate tibiæ outside, white; the 1st and 2d segments of the abdomen with white fasciæ on their apical margins; that on the second continued beneath. Wings hyaline, with their margins clouded.

Hab. St. Domingo.

The peculiar forms of this species not being very fully indicated, I cannot be certain of its position. I place it near to *O. totonacus*, to which it is allied by its livery, which is an indication of the group.

Here probably comes the position of two species of which I have no longer the types under my eyes, and which are not described with sufficient detail.

147. *O. Huo* SAUSS.¹—Parvulus, elongatus, gracilis, rugosus, niger; clypeo discoïdali, subbidentato; pronoto elongato, grosse punctato:

¹ Perhaps this might figure better in the subsection of *O. pennsylvanicus*, *perennis*, etc.?

abdomine gracili, punctato; antennis et clypeo omnino atris; puncto frontali, maculis 2 pronoti, tegulis partim, post-scutello et abdominis segmentorum 1^a, 2^a margine sat late, flavis; tertii fascia flava abbreviata; pedibus nigris, tibiis flavis, tarsis fuscis; alis subinfuscatiss. ♀.—Longit. 9.5 mm.

Odgn. Huro SAUSS. Et. Vesp. III, 297, 185, ♀ (1854).

Hab. United States.

148. O. Mohicanus SAUSS.—Minutus, gracilis, punctatus, niger; puncto frontali et post-oculari, maculis 2 pronoti, post-scutello abdominisque segmentorum 1^a, 2^a limbo, flavis. Tibiis flavis, tarsis fuscis. Alis hyalinis venis fuscis.—Longit. 8 mm.

♂. Clypeo discoidali, flavo, submarginato; puncto in labro et fascia in scapo flavis; antennis subtus ferrugineis.

Odgn. Mohicanus SAUSS. Et. Vesp. III, 297, 185, ♂ (1854).

Hab. United States. State of New York.

III. Metathorax not produced superiorly beyond the post-scutel, convex; its hinder face parted by a deep groove. POST-SCUTEL TRUNCATE; having a superior transverse face and a posterior vertical or oblique face; the two faces separated by a sharp edge.

Form quite elongate, exactly the same as in the last subdivision (II, 3),¹ very slender, elongate; the abdomen slender, spindle-shaped; its first segment funnel-shaped. Post-scutel always black; scutel often marked with yellow.—Insects small, black, shining, with pale ornaments.

These insects have much the appearance of those of the group of *O. Totonacus*, but the prothorax is marginate anteriorly and the scutel is maculate, not the post-scutel.

A. Metathorax quite unarmed superiorly.

149. O. Acolhuus SAUSS.—Parvulus, gracillimus, elongatus, niger, cribrato-punctatus; pronoto antice cristato-bidentato; post-scutello truncato, elevato-cristato; metanoto tenuiter punctato, inermi, biconvexo, per sulcum partito; abdominis primo segmento infundibuliformi, valde punctato, basi paulum petiolato, utrinque subdentato, supra tumido, ante marginem transversim subcanaliculato; secundo paulo depresso, basi coarctato; reliquis vix punctatis; pronoto, scutello abdominisque segmentis 1^o, 2^o, vel 1^o, 2^o, 4^o, flavo-marginatis; macula subalari

tibisque basi, flavis.—♂. Clypeo flavo-bidentato; antennarum scapo subtus flavo.

Odyn. Acolhuus SAUSS. Revue de Zool. IX, 1857, 280.

Total length, 7 mm.; wing, 5 mm.

Very small. Head circular or slightly wider than long, rather thick, emarginate behind. Sinus of the eyes not much opened on the inner side. Thorax wide anteriorly; prothorax having its anterior margin a little concave, crested, its angles spiniform or at least sharply angulate. Scutellum flat above, vertically truncate; the truncation making a hinder face, transverse, a little rounded on the lateral angles; the sharp edge separating the superior and posterior face quite crested; the crest erect, transverse, very finely crenulate (sometimes not well developed). Metathorax rounded-triangular, a little prolonged backward, convex, parted by a groove or a channel. Its apex with produced bifid articulate valves, but not spined. Head and thorax densely punctate, the metathorax more finely punctate than the rest, silky; the lateral ridges garnished with argenteous hair. Abdomen elongate, fusiform (spindle-shaped), subpetiolate; the first segment longer than wide; its base shortly petiolate, the remainder funnel-shaped, swelled above, a little toothed on each side; sometimes transversely channelled before the edge. Second segment not much elongate, bell-shaped, a little depressed. First segment cribrate like the thorax; 2d more finely punctured, except on its hinder margin; 3d and following segments not sensibly punctured.

Black. Head quite black; orbits silvery; a yellow spot at base of the scape. Anterior margin of prothorax, a spot under the wing, posterior margin of scutellum, articular valvæ of metathorax, and the margin of the first two abdominal segments, yellow. Tegulæ ferruginous. Feet black; tibiæ maculate with yellow at base; their apical spine yellow. Wings smoky, principally on the anterior margin.

Var. a Segments 3–5 margined with fuscous.

b. Fascia of scutellum wide or narrow.

c. Segments 4, or 4 and 5 incompletely margined with yellow.

♀. Clypeus ovate-circular, black, punctate, rather bidentate.

♂. Clypeus yellow, nearly heart-shaped, but reversed; the inferior part widest, with a little notch in the middle, forming

two small triangular teeth; scape of the antennæ beneath with a yellow line.

Res. a. diff.—A distinct, small species, well characterized by its truncate, crested, black post-scutel, which distinguishes it from *O. coyotus*, *tacubayæ*, *totonacus*, and by its smooth metathorax, which separates it from *chichimecus* and *tepanecus*.—Comp. with *O. zendalus*.

Hab. The temperate parts of Mexico. Several specimens were caught by me in the valley of Mexititlan, others were sent to me from Orizaba by Mr. Sumichrast (5 ♂, 13 ♀).

150. *O. Zendalus* SAUSS. (Fig. 24, 24a.)—Niger, nitidus; capite et thorace crasse punctatis; abdomine minus crasse et parum profunde punctato; scutello postice acute truncato, cristato; primo abdominis segmento trigonali-cupilliformi, superne tumido, præ margine constricto; pronoti margine antico, scutelli fascia, abdominisque segmentorum 1ⁱ, 2ⁱ margine, sulfureis. Alis fusco-nebulosis.—♀. Clypeo rugoso; antennis immaculatis.

Olyn. Zendalus SAUSS. *Revue de Zool.*, XXII, 1870, 140, 31.

Total length, 9 mm.; wing, 6.5 mm.

Form and appearance very much as in *O. Totonacus*. Head and thorax coarsely cribose. Thorax wide anteriorly, narrowed posteriorly. Prothorax finely crested, angulate. Post-scutel strongly truncate and sharply crested; its superior face very short; the posterior elevated face finely punctured; the crest forming the separation of the two faces finely crenulate, its angles well marked. Metathorax finely punctured, clothed with argenteous pile. Its cavity smooth, rather square. Abdomen spindle-shaped; the first segment cup-shaped, subtriangular, swelled above and constricted before its margin. The first three segments with very shallow punctures, rather large; the following finely punctured.

Black, shining. Head quite black. Anterior margin of prothorax, a fascia on scutel (or two spots), and the margin of the first two abdominal segments, yellow. Tegulæ and feet black; tarsi rather ferruginous. Wings clouded with brown.

♀. Clypeus rounded, rough, scarcely emarginate; antennæ quite black.

Res. a. diff.—Quite the appearance of *O. totonacus*, but very distinct from this by its crested and black post-scutel, anterior

yellow margin of prothorax, and strong punctures. It has much the form of *O. acolhuus*, but differs by its size (twice as large), its stronger punctures, its higher head, its first abd. segment, not petiolate at base, its rather different livery, its immaculate antennæ, flanks and tibia, ♀.

Hab. The temperate part of Mexico. Oriental Cordillera (Sumichrast).

B. Metathorax armed superiorly with two tubercles, sometimes very small.

151. *O. Nahuus* SAUSS.—Niger, gracilis, elongatus, crassissime cribri instar punctatus; pronoto bidentato; post-scutello antice transverse cristato, postice cribrato; metathorace producto, rotundato, foveola punctata instructo, superne bituberculato; abdominis 1^o segmento subpetiolato, 2^o elongato; reliquis tenuissime punctatis; pronoti margine antico, tegularum limbo, fascia scutelli, abdominis segmentorum 1^a, 2^a margine maculaque tibiarum, sulfureis.—♀. Clypeo nigro, rotundato, subbidentato.

Odyn. Nahuus SAUSS. *Revue de Zoolog.*, XXII, 1870, 140, 32, ♀.

Total length, 8.5 mm.; wing, 5.5 mm.

♀. Small. Very slender and elongate, having much the form of *O. Tacubayæ*. Head a little higher than wide, not much swollen behind. Thorax elongate; anterior margin of prothorax crested, its angles spiniform. Scutel having on its anterior part a fine transverse crest, finely crenulate; its hinder part behind the crest transverse, cribose, transversely square, very obtusely angulate. Metathorax prolonged, rounded, having a distinct concavity, nearly reaching the post-scutel; this cavity cribose like the rest of metathorax, its margins quite rounded, effaced, but having on the superior part two little rounded tubercles, punctured like the rest. Articular valves of the apex of the metathorax not spiniform, more flattened. Head and thorax exceedingly coarsely cribose; the metathorax not as coarsely so, but yet strongly. Abdomen elongate. The first segment cribose like the thorax, funnel-shaped, a little petiolate; about as wide as long, convex, and a little constricted before its margin. Second segment cylindrical, much elongated, though not strongly cribose. The following segments quite finely punctured.

Black, a little silvery sericeous. Head and antennæ quite

black. A narrow margin on the anterior border of prothorax, margin of tegulæ, a transverse band on the middle of scutel, and a narrow line margining the first two abd. segments, sulphur-yellow; that of the 2d complete beneath. Tibiæ marked with yellow. Wings smoky.

♀. Clypeus rounded, very coarsely punctured; its apex with two quite approximate, very small teeth.

Revs. a. diff.—This is an elongate species like *O. Tacubayæ*, very distinct by its quite coarse punctures, even on the 2d abd. segment; much coarser even than in *chichimecus*.

It differs: from *Tacubayæ* by its sharply angulate prothorax, crested scutel, bituberculate metathorax, and wider 1st segment, as also by the margin of 2d segment which is truncate, not arcuate; from *O. olmecus*, by its thorax, not triangular, not so wide anteriorly, not so attenuated posteriorly, its wider cup-shaped 1st segment, and by the tubercles of metathorax which are not sharp, but rounded and punctate: from *tepanecus* by most of the preceding characters. So also from *O. chichimecus*, except by its 1st segment which is shaped as in this species; the post-scutel also is not vertically truncate; its edge being an anterior ridge, not a posterior one. This last character distinguishes it also from *O. acolhuus*.

Hab. The temperate part of Mexico. Oriental Cordillera (Sumichrast).

152. *O. olmecus* SAUSS.—*Minutus, gracillimus, niger, punctatus; prothorace bidentato; post-scutello medio transverse cristato; metathorace infere foveolato, superne tenuissime bituberculato, apice bispinoso; abdominis 10 segmento elongato, infundibuliformi; capite omnino nigro, pronoti margine antico, macula subalari, tegulorum limbo, scutelli abdominisque segmentorum 1ⁱ, 2ⁱ (vel 1ⁱ, 2ⁱ, 4ⁱ) margine postico, flavis; spinis metathoracis apicis tibiisque extus, flavis.*

♂. *Macula mandibulorum, clypeo, scapo subtus, flavis; flagello subtus fulvo; clypeo latissime truncato.*

Odyn. olmecus SAUSS. *Revue de Zool.*, XXII, 1870, 140, 33, ♂.

Total length, 7 mm.; wing, 5.7 mm.

Small and slender, elongate. Having much the form of *O. acolhuus*. Head circular, rather swollen and concave behind. Antennæ inserted rather low. Thorax not very elongate, triangular, wide exteriorly, attenuated posteriorly. Prothorax

sharp, its angles dentiform. Post-scutel truncate, but its posterior face not so vertical, more oblique, its middle occupied by a transverse crenulated crest; the crenulations blunt. Metathorax triangular, prolonged, convex, with *lateral* sharp edges, clothed with white silvery pile; the middle occupied by a polished, punctured cavity, not reaching the top, but continued to the post-scutel by a groove. The superior margin of this cavity armed on each side with a very little, compressed, sharp tubercle (or a quite short ridge). The articular valvæ of the apex of the metathorax each bidentate, the superior tooth of which is prolonged into a long spine. Abdomen very elongate. The first segment longer than wide, funnel-shaped; with a sort of transverse depression before its margin. Second segment a little depressed bell-shaped, rather long.

Head, thorax, and 1st segment above, densely cribose, not quite as strongly as in *chichimecus*; the metathorax and the 2d segment quite finely punctured, except on the posterior part of the latter.

Black, sericeous. Head quite black. Anterior margin of prothorax, margins of the tegulæ, inferior spines of metathorax, posterior margin of scutel, and of the first two abdominal segments, yellow. Often the 4th segment also, more or less marginate. The crenulation of post-scutel, and the two little tubercles of the summit of metathorax finely punctate with yellow.

Feet black; knees and tibiæ outside, in their total length (♂) yellow; tarsi ferruginous beneath. Wings hyaline, smoky along the anterior margin.

♂. Clypeus having a quite exceptional form; square-rounded; as broad as high, or broader; its superior margin rounded; the inferior margin quite widely truncate, subconcave; its angles blunt, but the inferior extremity of the lateral margin rather swelled, somewhat tubercular. A spot on the mandibles, clypeus, a line under the scape, yellow; flagellum fulvous beneath.

Res. a. diff.—This differs from *O. chichimecus*, by its larger size, its head as wide as high; its prothorax much wider; its metathorax much more elongate and triangular, with a smaller cavity and quite small tubercles; its post-scutel shorter, with its crest placed near the anterior margin; by its first abd. segment much more elongate, funnel-shaped; by the 2d, quite finely punctured.—From *O. tepanecus* it is sufficiently distinct by its

metathorax, destitute of large tubercles, its crested post-scutel, and not spined clypeus (♂).

From *O. acolhuus*, it differs by its post-scutel not truncate so as to have a vertical posterior face, its crest being more anteriorly placed, not on the posterior ridge; by its metathorax, bituberculate superiorly and bispined at the posterior end. The 1st segment is also more elongate, and the clypeus ♂ is not angular-bidentate on its inferior margin. Comp. also *O. nahuus*.

From *O. coyotus* and *totonacus* it differs sufficiently by its crested truncate post-scutel.

Hab. The temperate parts of Mexico. One ♂ from the valley of Orizaba (Sumichrast).

153. *O. Chichimecus* SAUSS.—*Minimus, gracillimus, niger, cribrum instar punctatus; prothorace bidentato; post-scutello truncato, cristato; metanoto superne bituberculato; capite et antennis ♀ omnino nigris; prothoracis margine antico, scutelli et abdominis segmentorum 1ⁱ, 2ⁱ margine postico, flavis; tibiis et tegulis flavo-ornatis.*

Odyn. chichimecus SAUSS. *Revue de Zoolog.*, IX, 1857, 280, ♀.

Total length, 6 mm.; wing, 4.5 mm.

♀. The smallest species. Head a little higher than wide. Antennæ inserted below its middle. Sinus of the eyes very open. Thorax slender, not contracted anteriorly; its anterior margin finely crested; its angles toothed. Post-scutel truncate; its ridge arcuate, crested, but not very strongly. Metathorax convex, prolonged, having a polished shallow cavity, not extended superiorly to the post-scutel; superiorly this cavity is margined on each side by a little compressed sharp tubercle. Extremity of metathorax with two little spines, next to the two teeth which make the articulation. Abdomen elongate; the first segment triangular funnel-shaped, swelled and a little constricted before its margin, which is rather thick. Second segment cylindrical; head, thorax, and first abdominal segment polished and cribose with strong punctures; metathorax and second segment not quite as strongly cribose, and with a line of stronger punctures along its margin. Metathorax finely punctured. Segments 3-6 quite finely punctured. Black. Anterior margin of prothorax, posterior margin of scutel, and of the first two abdominal segments of the abdomen, yellow; wing scales marginate with yellow; tibiæ yellow on the superior face, at least at base. Wings subhyaline.

Var. The yellow band of scutel interrupted.

♀. Head and antennæ quite black. Clypeus cribose like the head; having the shape of a square lozenge, its inferior margin arcuate, imperceptibly bidentate.

Res. a. diff.—This species has much resemblance to *O. Tacubayæ*, because of its elongate 2d abd. segment, but it is quite distinct from it, as also from *O. coyotus* and *totonacus*, by its truncate, crested post-scutel, and its *bidentate metathorax*. This last character only separates *O. tepanecus*, *olmecus*, and *nahuus*.

Hab. The temperate parts of Mexico. I caught one ♀ in the valley of Mexitlan.

154. *O. tepanecus* SAUSS.—Parvulus, gracilis, niger, tenuiter punctatus; post-scutello truncato; metathorace valde bituberculato; abdominis 1^o segmento infundibuliformi, subpetiolato; apice puncto impresso notato, capitis punctis, pronoti, scutelli, abdominisque segmentorum 1ⁱ, 2ⁱ (vel 1ⁱ, 2ⁱ, 4ⁱ), margine, flavis; tibiis basi flavo-variis.—♂. Clypeo flavo, apice spinis 2 nigris, antennis nigris.

Odyn. Tepanecus SAUSS. *Revue de Zool.*, IX, 1857, 280, ♂

♀. Total length, 7.5 mm.; wing, 5.5 mm.

Very small. General form very much as in *O. acolhuus*, slender. Head circular or a little higher than wide. Antennæ inserted rather low. Notch of the eyes very open. Prothorax not having its angles dentiform. Scutel truncate, transverse, not crested, but having a transverse edge. Metathorax triangular, a little prolonged; its *lateral* edges arcuate, sharp, hairy; its hinder face parted by a deep channel and armed on each side under the angles of post-scutel with a strong, sharp, dentiform tubercle, looking backward; these tubercles compressed, having a sharp, lateral salient ridge, extending to the angles of post-scutel (very evident, when viewed in profile). Apex of metathorax with two wide articulate, not spined valvæ. Abdomen slender, spindle-shaped; first segment small and narrow, subpetiolate, funnel-shaped, but swelled above, gibbous, as if truncate anteriorly; an impressed point before its posterior margin. Second segment rather oval, narrowed but not constricted at base, rather depressed, but not all tuberculate. The whole insect finely punctured.

Black, sericeous. A frontal, ocular, and post-ocular spot, yellow. Anterior margin of prothorax, posterior margin of scutel, articular valvæ of the metathorax, and the first two seg-

ments of the abdomen, yellow. The 4th segment (often ?) with an incomplete yellow band. Wing scale brown, margined with yellow or ferruginous. Feet black; tibiae at base outside and their apical spines, yellow. Wings smoky.—♀. Clypeus yellow, widened below, terminated by two very strong, blunt, black spines. Mandibles and antennae wholly black. A yellow line between the insertion of the antennae.

Rees. a. diff.—This small species is quite distinct by its strongly tuberculate metathorax. It could only be confounded with *O. chichimecus*, but it is not so small, nor as slender; the thorax is not as cylindrical; the body not as strongly punctured; the scutellum is not crested; the metathoracic tubercles are much stronger and the direction of the sharp external ridge of these is convergent downward, while in *chichimecus* the tubercles are on the contrary a sort of superior margin of an indicated cavity of the metathorax.

Compare also *O. olmecus* and *nahuus*.

Hab. The temperate parts of Mexico. I caught only one male in the valley of Mexitlan.

Subgenus **EPIPONUS**¹ SHUCK.

Epipona SHUCK.; SAUSS.—*Oplopus* WESM.; SAUSS. Vesp. I, 217.—

Oplomerus WESTWOOD.—*Pterochilus* ex. p. HERR.-SCHNEFF.

Abdomen quite ovate, depressed; the first segment cup-shaped, sessile, or subpedunculate at base, sensibly narrower than the 2d, but not constricted at base. Thorax short, rather globular. Metathorax rounded, destitute of angles and of sharp edges, without rugosities. Second recurrent nerve of the anterior wing falling upon the 2d transverso-cubital nerve or very close to it.—(Appearance of the genus *Pterochilus*.)

♂♂. Antennae having at times the last joint recurved like a hook; these organs being more often elongate, thick, with their last joints compressed, flattened, curled up to a spiral.—Clypeus generally wider than long; very strongly bidentate.

This type quite recalls the appearance of *Pterochilus* and it forms the intermediate step between these insects and the true *Odynerus*. The characters of the Division *Epipona* are principally to be found in the males, but the appearance of these insects

¹ *επιπώνος*, laborious.

is sufficient to distinguish them; it is even so striking that one would be tempted to raise it to a genus, did there not exist, principally in Europe and in Africa, a series of intermediate types which allies them by very gradual and natural transitions to the true *Odyneri*. These transitions are even so complete that one is much perplexed to know how to limit the subgenus *Epiponus*.¹ But as the intermediate types are principally inhabitants of the old world, the difficulty with the American species is much diminished, although it appears in the case of some *Antepiponus*.

The *Epiponus* seem to be peculiar to the boreal hemisphere and to Africa; the true *Epiponus* are the northern type, the *Antepiponus* the southern type, as well in America as in Europe.

Division ANTEPIPONUS.

(SAUSS. Et. Vesp., III, 244.)

Mandibles of the males not notched, nor armed with a spur.

Antennæ of the males either armed with a hook, or curled up into a spiral at the extremity. First abdominal segment cup-shaped, sessile or rather subpedunculate at base. As said above, I at first placed this division in the subgenus ODYNERUS, but the appearance of its representatives being quite that of the EPIPONUS, it will better find its place in this division.

1. *Antennæ of the males terminated by a hook.* (Sauss. Vesp., I, 213, Sect. C.)

No representative yet found in America.

2. *Antennæ terminated by a spiral curl.* (Sauss. Vesp., I, 216, Sect. II°.)

This section only differs from the true *Epiponus* by the mandibles of the males being simple, and the clypeus not so much

¹ In my *Etudes sur la Fam. des Vespides*, I have included these transitory species in the division *Antepipona* (III, 298), but this division is only an expedient to help in the determination of the species; it is not a natural division—no more than any section one must form in a continuous series, conducting from one form to another by gradual transitions. (Comp. Et. Vesp., Vol. I, 213, C, and 216, II.—Ibid., Vol. III, 298.)

notched. It quite approaches *Pterochilus* in its general forms and in the shape of the clypeus. It only differs from these by the labial palpi being small, 4-jointed and not pectinate.

It has the same geographical distribution as the *Pterochilus*, being the southern type of the genus. In America it has only been found in Mexico as yet; in the old world it is spread over the southern part of Europe and the temperate part of Africa, north and south.

155. *E. denticulatus* SAUSS. (Fig. 30, 30a.)—*Validus, niger, fulvo-hirtus*; pronoto, post-scutello, abdominisque segmentis flavo-limbatis; secundo segmento, utrinque macula rufa; antenarum basi et pedibus badiis.—♂. Clypeo flavo, apice nigro; femoribus intermediis emarginatis; tibiis posticis dilatatis.

Leptochilus denticulatus SAUSS. *Rev. de Zool.*, VII, 1855, 373.¹

Total length, 14 mm.; wing, 11 mm.

Appearance of a *Pterochilus*, but the labial palpi small, quadriculate, not pectinate. Mandibles knife-shaped, with three little notches. Thorax ovate, round; first abdominal segment cup-shaped, or widely spoon-shaped, not very sessile; its base subpedunculate. Second segment short. The whole insect densely punctured and hirsute with long fulvous hair.

Black. Anterior margin of prothorax and post-scutel sulphur-yellow. Wing scales ferruginous or yellowish. The abdominal segments all adorned with a sulphur-yellow margin, rather wider on the 3d, 4th segments than on the 2d; the margin twice notched with black on the segments 3–6; the 2d segment adorned besides with two large ferruginous lateral spots. Feet ferruginous or yellowish, black at base. Wings subhyaline, soiled with gray-ferruginous.

Var. Post-scutel black; tegulæ maculate with yellow.

♂. Clypeus wide below; attenuated at its summit; its apex but little prolonged, truncate, biangulate. The surface yellow, clothed with silvery hair, except on its extremity which is black and strongly punctured. Antennæ very long, black, with the first two joints ferruginous, yellow anteriorly; the last joints quite compressed, annulate with yellow, principally below. Intermediate femora of rather different form, strongly canaliculate

¹ *Erratum*.—Page 373, line 19th, instead of *Tibias*, read *Facies*.

beneath, and strongly notched beyond the middle, on their anterior face; the notch almost forming three-quarters of a circle; its angles quite sharp, dentiform. Posterior tibiæ strongly dilated, somewhat as in the Melliferæ, terminated very widely; the inner angle forming almost a process.

Res. a. diff.—This insect has quite the appearance of *Pterochilus aztecus*, but it differs by its small and not feathery labial palpi.

Hab. Mexico. I caught but one specimen in the Cordillera of Coscomotepec.

Division EPIPONUS (proprie dieta).

Mandibles of the males having beyond the middle a large notch, followed by a tooth or spur. Antennæ elongate, thick; their extremity curled up into a spiral. Clypeus ♂ wider than long, very strongly bidentate.—The second recurrent nerve of the anterior wing falling upon the 2d transverso-cubital nerve, or very near it.

The true *Epiponus* seem to be peculiar to the temperate and northern parts of the southern hemisphere; they are abundant in Europe, rare in America; in the lower latitudes they give place to the *Antepiponus*, which, with the same appearance, approach more nearly to the true *Odynerus*.

In regard to the distinction of the species one must notice that, contrary to the usual case, in this group it is not the female, but the male, which offers the most distinctive characters.

Beside the subgeneric characters, peculiar to the total number of the males, there are others specially belonging to a part of the species; some have the coxæ or intermediate femora indented; others have the clypeus curiously shaped. But the females are far from being so well characterized, and the distribution of the colors must be strongly relied upon in distinguishing the species.

156. E. dilectus SAUSS. (Fig. 29, 29a.)—Niger, punctatus, fusco-hirsutus; frontis macula, puncto post-oculari, tibiis, tarsis abdominaque segmentorum limbo, sulfureis; ultimis segmentis tantum fascia abbreviata flava; alis subhyalinis, tegulis fusco et flavo maculatis.—♂. Clypeo flavo, valde bidentato, ore et antennis subtus flavis; femoribus intermediis tridentatis.

Odyn. dilectus SAUSS. Revue de Zool., XXII, 1870, 141, 34, ♂.

♂. Total length, 9 mm.; wing, 8 mm.

Head very densely punctured; thorax closely shagreened. Post-scutel truncate, having an elevated posterior face; meta-thorax quite rounded, posteriorly more flattened than excavated, strigose. Abdomen quite ovate, polished; the first segment cup-shaped, anteriorly somewhat rounded truncate.

Black; the body all bristling with long fulvous hair, especially on the head and thorax; that of the abdomen shorter and more gray. A frontal transverse mark, a post-ocular spot, and the margin of the middle of prothorax, sulphur-yellow. Wing scales testaceous, black at base. A regular yellow fascia on the segments 1-5 of the abdomen; the fasciæ 3-5 abbreviated. Feet black; knees, tibiæ, and tarsi, yellow (♂). Wings subhyaline. The 2d recurrent nerve falling nearly into the 3d cubital cell.

♀. Unknown.

♂. Mandibles yellow, having near the extremity a strong notch, followed by a stout tooth. Labrum yellow. Clypeus wider than long, yellow, terminating in two long teeth, separated by a wide notch in the form of an arch. Antennæ very large, thick, black above, yellow beneath; the last six joints flattened and rolled up into a spiral, quite black. Intermediate femora strongly bidentate beneath; their first tooth slender and elongate, in form of a broken spine; the intermediate shorter and more widely compressed, the third forming a sort of lamella attenuated up to the extremity of the femur, these teeth separated by wide notches. Intermediate tibiæ apparently notched at base and tumefied from the middle. The 6th segment slightly margined with yellow.

Res. a. diff.—This is the only American representative known of the subgenus *Epiponus*. Compared with the European species, it quite resembles *O. spinipes*, except that the 3d tooth of the intermediate femora is not quite so much developed. It might be *O. spinipes*, transmigrated and modified.

APPENDIX TO THE GENUS ODYNERUS.

1. *Species sedis incertæ.*

The following species I cannot introduce in the classification of the genus, their forms not having been sufficiently described.

1. *O. rufinodus* CRESSON.—Niger, valde punctatus, albido variegatus; metathorace rufo, utrinque dentem efficiente; abdominis segmentis 1-3 luteo-limbatis; 1♂, 2♂ margine reflexo; pedibus rufis; alis nebulosis.

O. rufinodus CRESS. Amer. Ent. Trans., I, 1867, 381, 22, ♀.

Total length, 3.5 lines.

♀. Black, densely and deeply punctured; head large, face and base of clypeus with glittering pubescence, the latter subconvex; mandibles rufous, black at tips, the inner edge with three obtuse teeth; palpi honey-yellow; antennæ short, clavate, entirely blackish; a transverse line, interrupted medially on prothorax, a round spot on each side of pleura, tegulæ, except a brown medial spot, and two spots on scutellum, white; metathorax rufous, silvery on the sides, deeply excavated posteriorly, the extreme lateral apical angles produced into a subacute spine; wings subhyaline, the costa narrowly fuliginous; legs entirely rufous, the posterior tarsi slightly dusky; abdomen with the apical margins of the first and second segments reflexed and narrowly whitish, as well as that of the third; basal segment campanulate, convex, without any transverse carina and suture at base, rufous; second segment suddenly swollen, convex, its posterior whitish, margin sinuous anteriorly, and continued, narrowly, beneath; fourth and following segments entirely black.

Hab. New Mexico. 1 ♀.

This species is most likely very variable in its colors. It may prove to belong to Division *Odynerus*.

2. *O. productus*.—Niger; capite thoraceque flavo-guttatis et valde punctatis; abdomine fasciis duabus flavis ornato.

O. productus SMITH, Lond. Ent. Trans., 3d Ser., I, 1862, 37, ♂.

Total length, 3.5 lines.

♂. Black, the head and thorax strongly punctured; the clypeus and a small spot above it, a minute spot in the sinus of the eyes and another behind them, the scape in front and a spot on the mandibles, pale yellow; the flagellum fulvous beneath. The posterior margins of the prothorax, a spot beneath the tubercles, the tegulæ, post-scutellum, the metathorax behind, and a spot on the anterior and intermediate tibiæ, yellow; the anterior tibiæ and tarsi ferruginous; the wings hyaline, with a dark fuscous stain in the marginal cell; a ferruginous spot on the tegulæ. Abdomen finely

punctured, the first and second segments with a broad yellow margin, which is continued beneath; the second segment produced in the middle, forming a sharp angle or tooth; the following segments very narrowly bordered with yellow; the first segment entirely pale beneath.

Hab. Panama

This species is very likely to be classed in Division *Stenodynerus*.

2. *Species dubia.*

The following species I first thought by its facies to be a North American one, but as it never occurred to me in any American collection, I must deduce from this fact that it did not originate on this continent.

It would find its place in the Division *Odynerus*.

O. Tisiphone LEP.—Omnino niger, sat gracilis; clypeo vix emarginato, carinato-subdentato; metanoti marginibus superne paulum elevatis, acutis; post-scutello flavo; abdominis primo segmento anguste, secundo tenuissime sulfureo-limbatis; alis nigro-violaceis. ♀.—Long. 15 mm.

Odynerus Tisiphone LEP. ST. FARG., *Hymen.* II, 646, 31, ♀ (1841).—
SAUSS. *Vespides*, I, 183, 77.

Hab. ? (America?)

Gen. **LEPTOCHILUS** SAUSS.

*Leptochilus*¹ SAUSS. *Etud. Vespid.*, I, 233, III, 320.

Appearance of genus *Odynerus* (*Stenodynerus*), but the abdomen is subpedunculate; its first segment more or less funnel-shaped.

Labial palpi very slender. Maxillary palpi slender.

This genus should evidently be united with the genus *Odynerus*, and will most likely find its place in the *Stenodyneri*, next to the group of *O. huastecus*. Unfortunately, not possessing the types, I cannot exactly decide how the species should be placed.

The abdomen is constricted between the 1st and 2d segments, more than in the *Stenodynerus*; nevertheless, this is only a provisional genus which cannot well be preserved.

¹ λεπτός, thin; χείλος, lip.

1. *Maxillary palpi quite slender. First abdominal segment subpedunculate, much narrower than the second.*

1. **L. fallax** SAUSS.—Sat minutus, niger, pronoto antice lato; subangulato, scutello subquadrato; metanoto postice valde excavato, marginibus rotundatis, rugosis; abdominis primo segmento convexo, infundibuliformi, minus lato quam secundum; hoc basi subconstricto, margine reflexo, valde rugoso; capite, thorace et abd. 1^o segmento valde punctatis; puncto frontali et post-oculari, sulfureo; antennis subtus et basi, ferrugineis; pronoto, tegulis, macula subalari, post-scutello, pedibus et nonnunquam metanoti lateribus, rufis; pronoto insuper antice flavo marginato; abdominis primo segmento rufo, basi nigro, margine flavo; secundo flavo-marginato; basi rufo-bimaculato; 3^o et 4^o (♂) tenuissime flavo-marginatis; alis hyalinis.—Long. 11 mm.

♂. Clypeo rotundato, flavo, subbidentulato; scapo antice fascia flava; orbitis intus flavo-marginatis.

Leptochilus fallax SAUSS. Et. Vesp. I, 234, 2, pl. xx, fig. 6, ♂ (1852).

Hab. America?

Observation.—Unfortunately, I do not find this species again in the collection of De Romand, in which I described it. As the insects of this collection were very negligently labelled, it may not be an American species?

2. *Maxillary palpi moderately slender, the first joint rather swelled. First abd. segment rather wide posteriorly, although still not funnel-shaped.*

2. **L. ornatus** SAUSS.—Niger, valde punctatus; clypeo latiore quam longiore; post-scutello truncato, cantho acuto instructo; metanoto excavato, marginibus rugosis, rotundatis; abdomine basi subpedunculato; primo segmento valde punctato, margine subreflexo; secundo brevi et latissimo, basi valde coarctata, margine subinorassato; ore et scapo fuscis; clypeo flavo, margine nigro; pronoti margine, tegulis, macula subalari, fasciae interrupta in scutello, aurantiacis; primo abdominis segmento obscure rufo; segmentis 10–30 tenuiter aurantio-marginatis; pedibus flavis, basi nigris; alis subhyalinis.—Longit. 9 mm.

♂. Clypeo et antennarum scapo fere omnino flavis.

Leptochilus ornatus SAUSS. Et. Vesp. I, 236, 6, pl. xx, fig. 4, ♀.

Hab. United States. Carolina (Paris Museum).

Gen. **PTEROCHILUS** Klug.*Pterochilus* KLUG.; LATR.; SAY; SAUSS.

Buccal parts elongate.

Labium very much elongate; palpi very large, thick, and much elongate, composed of three joints, of which the first is swelled at the extremity; the 2d and 3d strongly compressed and bipectinate, with very long pilosity; the 3d joint very elongate.—*Maxillary* palpi normal, composed of six joints.—*Mandibles* large, elongate, trenchant, in the form of a knife blade; the internal edge trenchant, lobed, or notched; the external edge ciliated with long hair.—*Clypeus* wide, often lozenge-shaped or trapezoidal, more or less transverse.—*Thorax* rounded anteriorly and posteriorly, globular or ovate.—*Abdomen* ovate, depressed, the first segment cup-shaped, subsessile.—*Antennæ* of the males terminated by a hook or by a curved spiral.

These insects have much the same appearance as the *Epipona*, but they are very distinct by the extraordinarily large labial palpi, which are feathery, with very long hair.

The American species belong to the group of *Pt. phaleratus* and *biglumis*, characterized by their indented mandibles and rounded metathorax.

1. *Pt. Lewisii* CRESSON.—*Validus*, niger, fulvo-pubescent; clypeo, antennis basi, capitis maculis, pronoti macula subalari, maculis 2 scutelli et 2 metanoti pedibusque ferrugineis; tegulis et post-scutello flavescentibus; abdominis segmentis 1^o, 2^o rufis, basi nigris, omnibus flavo-limbatis; alis inquinatis.

Pterochilus Lewisii CRESSON, Amer. Entom. Trans., I, 1867, 382, 25, ♀.

Total length, 8.5 lin.

♀. Robust; head and thorax clothed with a pale fulvous pubescence; abdomen silvery-sericeous in certain lights. Head black, densely punctured; posterior orbits broadly, anterior orbits narrowly, from the emargination down, the clypeus entirely, the mandibles, except the tips and base and lower margin

beneath, bright ferruginous; clypeus subconvex, sparsely punctured, pubescent, the tip produced and truncate; mandibles large, long, acute at tip, with four obtuse teeth on the inner edge before the tip; the outer surface with two oblique carinæ, the lower margin fringed with long yellow hair; maxillæ blackish, their palpi fulvous, the apical joints fringed with very long hair; antennæ black, the two basal joints bright ferruginous. Thorax very densely punctured, black, the upper half of prothorax, spot beneath anterior wing, two large, almost confluent spots on scutellum, and the sides of the metathorax, bright ferruginous; post-scutellum and tegulæ, except a central darker spot, yellowish-ferruginous; metathorax short and very abrupt. Abdomen robust, sessile, very densely punctured; first and second segments dull-ferruginous, with their apical margins bright yellow, and a larger black spot on their basal middle; that on the first segment longitudinal and even, that on the second transverse, angular on the sides and acutely pointed behind; the yellow posterior margin of the second segment is slightly and squarely emarginate on each side anteriorly; remaining segments bright lemon-yellow, the third and fourth more or less black at base; the two apical segments are tinged with orange and the third to fifth segments have a transverse orange spot on each side; beneath ferruginous, with a lateral yellow spot at tip, and a large semicircular black mark on the base of the second segment. Legs ferruginous; coxæ and trochanters black; the four posterior tibiæ and base of tarsi covered with short spines. Wings subhyaline varied with fuliginous; the costa and base stained with yellowish, sub-violaceous.

Hab. New Mexico (Museum of the Am. Entom. Society).

2. *Pt. Mexicanus* SAUSS. (Fig. 31, 31a).—*Validus, niger, fulvo-hirsutus; ore, clypeo, macula frontali, orbitis partim, antennis basi, pronoto, lineis 2 mesonoti disci, tegulis, maculis pleurarum, scutellis, metanoto utrinque, pedibusque rufis; abdomine rufo, segmentis flavo-imbatis, 10, 20 basi nigris; alis infuscatis, violascentibus.* ♀.

Pterochilus mexicanus SAUSS. *Rev. de Zool.* XXII, 1870, 141, 36 ♀.

Total length, 16 mm.; wing, 14 mm.

♀. Large. Labial palpi very large, ciliated with very long black hair. Clypeus strongly punctured, truncate; its extremity rather excavated in the middle, with oblique submarginal lateral

carinæ below, terminating in its angles. Thorax not globular, rather elongate, ovate. Scutel convex, parted by a groove; post-scutel not parted. Metathorax rounded, divided by a channel. Abdomen a little more elongate than in *Pt. aztecus*, the first segment not so short, subangular posteriorly.

The whole insect densely punctured and clothed with fulvous woolly hair.

Black. Mandibles, clypeus, the first two joints of the antennæ, frontal spot, inner orbits and a large post-ocular band, rufous; the clypeus above and scape beneath, yellow. Prothorax above, two spots or a band on the flanks, tegulæ, two lines on the disk of mesothorax, scutel, post-scutel, and two large maculæ on the metathorax, rufous. Abdomen rufous, with a central band on the 1st segment, and a triangular part at base of 2d segment, black; all the segments more or less margined with yellow; anus yellow. Feet ferruginous, black at base; coxæ spotted with ferruginous; tibiæ of the two posterior pair covered with small spines. Wings pale fuscous, with violet iridescence.

Var. This species certainly varies greatly in the distribution of its three colors, the black and yellow being more or less extended.

Res. a. diff.—It differs from *O. aztecus* by its coloration and particularly by its thorax, not globular, but ovate, much longer than wide. It is very likely to be a Mexican variety of *Pt. Lewisii* Cress. I cannot be sure of this without an examination of the type. It has the wings more violaceous, not ferruginous along the costa; the disk of mesothorax is adorned with two rufous lines and the abdomen may not be as sessile.

Hab. Mexico. One ♀ I caught in the valley of Mexico, on the high plateau.

3. *Pt. Aztecus* SAUSS.—Validus, niger, tenuissime punctatus; capite et thorace fulvo-lanosis; abdomine ovato; ore, antennarum basi et pedibus rufis; clypeo flavo, apice grosse punctato, bicarinato, infra medium nigro-bimaculato; puncto post-oculari, maculis 2 pronoti, post-scutello et abdominis segmentorum limbo, flavis; segmentis 10, 20 utrinque macula rufa; alis subinfuscatis, costa basi ferruginea; tegulis rufis. ♀.

Pterochilus aztecus SAUSS. Rev. de Zool. XXII, 1870, 141, 35 ♀.

Total length, 16 mm.; wing, 12 mm.

♀. Mandibles large, armed with three lobiform teeth, beside the apical point; their external sides strongly ciliated with

long hair. Labial palpi very large, strongly pectinate with long hair.

Clypeus convex, punctate, truncate and rather bituberculate at tip. The whole body densely punctured and clothed with woolly ferruginous hair. Thorax globular, scutel and post-scutel parted by a groove, anteriorly rather carinated; metathorax quite rounded, finely strigate in the middle. Abdomen regularly ovate, subsessile; second segment beneath with a transverse carina at base.

Black. Mandibles and the first two joints of the antennæ, ferruginous. Clypeus yellow or ferruginous, with two black marks below, laterally. A post-ocular line, two spots on prothorax and a line on post-scutel, yellow or rufous; tegulæ rufous. Abdominal segments all margined with yellow; the margins twice notched; that of the 2d segment narrower, rather sinuous. The 2d segment having on each side also a large rufous separate spot, and the 1st segment two similar lateral spots, but placed on the yellow margin. Anus marked with yellow. Feet ferruginous, black at base. Wings smoky; the anterior margin as far as the stigma, ferruginous.

Var. Post-scutel with an interrupted yellow line, or black.

Reuss. a. diff.—This differs from the African species by its not salient post-scutel, its metathorax not excavated, but small, rounded, convex, only slightly channelled in the middle; even its lateral ridges quite blunt. It most resembles *Pt. biglumis* Sauss., but the clypeus is more convex and not notched. It differs from *Pt. mexicanus* by its globular thorax, nearly as wide as long.

Hab. Mexico. I caught one ♀ near Orizaba.

4. *Pt. quinque-fasciatus* SAY.—Niger, mandibulis emarginatis, clypeo, antennarum scapo, prothorace, tegulis; metanoto utrinque pedibusque, ferrugineis; macula subalari maculis 2 scutelli, post-scutello et abdominis fasciis quinque, flavis; segmentis 10, 20 utrinque macula ferruginea.

Pt. 5-fasciatus SAY, in Long's Exp. to the sources of the St. Pet. Riv., II, Supp. 70 (1824).—SAYSS. Et. Vesp. I, 248, 13; III, 323.—Say's Entomol. (LE CONTE), I, 234.

Rhygchium 5-fasciatum SAY, Bost. Journ. I, 1837, 385.—SAUSS. Et. Vesp. I, 118.—Say's Entomol. (LE CONTE), II, 765, 2.

Total length, 20 mm.

"♀. Head black, dilated; posterior and anterior orbits, to the emargination of the eyes, ferruginous; hypostoma, scapus of the antennæ, and mandibles, ferruginous; flagellum black-brown; labial palpi testaceous, very long, ciliate with long hair, three-jointed, terminate joint much compressed, flat, obtuse at the tip; stethidium black; collar and wing scale ferruginous; scutel with two large yellow spots; metathorax, with a transverse yellow line, and at the base on each side, a large ferruginous spot; wings a little fuliginous; pleura with a yellow spot beneath the superior wings; feet ferruginous; tergum black, with five broad, bright yellow, somewhat dentated bands, the posterior one abbreviated; first and second segments each with a large ferruginous spot on each side; venter black, ferruginous at its base."

Hab. Missouri.

I do not know this species. It seems to be very near to *Pt. aztecus*, but with a richer coloration.

Gen. **CTENOCHILUS**¹ SAUSS.

Epipona SPIN.—*Pterochilus* SAUSS.—*Ctenochilus* SAUSS. Vesp. III, 323.

Labial palpi pectinate as in *Pterochilus*.

Mandibles rather short, nearly obliquely truncate, strongly indented.—*Prothorax* angulated.—*Abdomen* petiolate; the first segment quite contracted in its whole length into a petiole as in *Eumenes*.

This genus represents the petiolate *Pterochilus*, and it bears the same relationship to this genus as *Eumenes* to *Odynerus*. It presents, however, this difference; the prothorax is angulated and crested, which is not the case in *Pterochilus*. It has somewhat the facies of *Zethus* in the form of the petiole, the transverse clypeus, the rather short mandibles (and the labial palpi, probably formed of three joints only, which I cannot verify).

The *Ctenochilus* occupy an intermediate group between *Zethus* and *Pterochilus*.

Ct. pilipalpus SPIN.—Gracilis, capite magno, postice excavato; clypeo transverso, apice tridentulato, fimbriato; pronoto cristato-marginato; scutellis prominulis; petiolo lineari, apice globoso-inflato; clypeo

¹ κτείς, κτενός; comb; χεῖλος, lip.

rufo, nigro-marginato et utrinque punctulo albido; antennis rufis, apice nigris; pronoto, macula subalari, fascia scutelli, post-scutello, punctis 2 in summo metanoto tegulisque, luteis; petiolo apice, luteo-marginato; abd. segmentis 2♂, 3♂ luteo-limbatis, secundo insuper basi fascia lutea; pedibus rufis; alis ferrugineis, apice griseis, ♀.—Longit. 13 mm.

Epipona pilipalpa SPINOLA, in Gay's Hist. fis. de Chile, Zool., VI, 252 (1851).

Pterochilus pilipalpus SAUSS. Et. Vesp. I, 247, 12, pl. xx, fig. 8.

Hab. Chili (1 ♀ in the Paris Museum).

This insect is a native of Chili, and has the same sort of livery as most of the *Hypodynerus*, the *Gayella* and *Alastor* from Chili; that is, black, hirsute, with rufous feet and white fasciæ and rather ferruginous wings, fuscous at tip. This livery of the Chilian Vespidae is one of the most characteristic to be met with in the geographical distribution of insects.

Gen. **ALASTOR** LEPEL. ST. FARG.

Alastor LEP.; SAUSS.; SMITH.

The same characters as in *Odynerus*.—Abdomen sessile.—*The second cubital cell of the anterior wing petiolate upon the radial cell.*

The *Alastors* are only, so to speak, but *Odyneri*, in which the 2d cellule of the wing becomes petiolate. This modification can produce itself in every section of the *Odyneri*; so one finds among the *Alastor* some types corresponding with the *Odynerus*, reproducing the same modifications of form.

The genus *Alastor* in effect offers, like the genus *Odynerus*, types of the metathorax angulated or blunted, with ridges trenchant or without salient borders; types with a suture on the first abdominal segment or without suture, and forms the most varied, appear also in the shape of the first segment.

These insects present themselves as if forming a series parallel to the *Odyneri*, of which the diverse varieties of form seem to be almost born of similar types, taken from the series of *Odynerus*, types which are changed by the modification of the alary venation.

In this genus, as in all others, one finds transitions to neighboring genera. The second cubital cellule sometimes becomes

very slightly pediculate (or even triangular), terminating toward the radial in a point or a subpediculate point, which constitutes an insensible passage to the *Odynerus*. So the *Odynerus Alastoroides* might figure indifferently in the one or the other of the two genera.

The *Alastor* is met with on all the continents, but it is rare or in all cases very much less numerous than the *Odynerus*. It is in Australia that it attains its maximum development, and in that region of our globe it appears almost to balance the *Odynerus* by the number of its species. In Europe but one species is known. America furnishes a small number of species, but doubtless more will yet be collected. It is probable that the United States possess their *Alastor* as well as Europe, although it has not yet been met with.

The species of the new continent form a peculiar type with a form lengthened and cylindrical, recalling the *Stenodynerus* and the *Stenancistrocerus*, but with the peculiar characteristic of having the metathorax notably prolonged beyond the post-scutel, and then abruptly truncate, and offering a circular concavity, bordered by a ridge, very trenchant and of a circular form.

Subgenus **ALASTOROIDES.**

(SAUSS. Vespides, III, 327.)

First abdominal segment parted by a transverse suture.

The American species form the

Division **HYPALASTOROIDES.**

(SAUSS. Vespides, III, 328.)

Metathorax superiorly produced behind the post-scutel; then truncate. Its margins sharp.

1. A. Mexicanus SAUSS.—Gracilis, niger, crasse punctatus; pronoto lato, biangulato; metanoto valde rugoso, pone post-scutellum producto, postice valde foveolato; foveolæ marginibus superne semicirculariter arcuatis, acutissimis, denticulatis, marginibus inferis horizontaliter in lamellam bilobatam productis; abdomine basi acute truncato; pronoti et abd. segmentorum 1ⁱ, 2ⁱ margine, scutelli margine interrupto, metanoti canthis inferis, fasciaque tibiarum, flavis; alis nebulosis

venis nigris.—♂. Clypeo grosse cribrato, superne flavo, apice late emarginato.—*Variat*: Tertio segmento flavo-marginato.

Alastor mexicanus SAUSS. Revue de Zoolog., XXII. 1870, 141, 37, ♀.

♂. Total length, 9 mm.; wing, 7.5 mm. (*var.* length, 8 mm.; wing, 6 mm.)

Body slender and cylindrical. Head rather thick. Thorax convex, widest anteriorly, rather attenuated behind. Prothorax having its anterior margin crested; its angles rather spiniform. Scutel and post-scutel quite flattened, not at all salient, continuing the surface of the thorax, which is further continued behind the post-scutel by the metathorax. Head and thorax densely and coarsely cribose. Metathorax narrower, quite rugosely sculptured, vertically truncate; its hinder face quite excavated, polished and sparsely punctured; its margins quite sharp, forming superiorly a semicircle, not interrupted in the middle, trenchant and acutely denticulate; the denticles forming a sort of erect crest; inferior margins transverse, forming on each side a kind of rounded lamella, having a species of tooth at its base, or bilobed. Abdomen quite sessile, shallowly punctured, the first segment not as wide as the second, short, sparsely truncate anteriorly, its anterior and superior face separated by the suture, which makes a transverse ridge, almost a crest, the second segment having its margin smooth, but this is preceded by a line of strong impressed punctures. The following segments having their margins smooth also, the base punctured, and the two zones separated by a transverse impressed punctate line.

Black. A dot behind the eye, a narrow line on the anterior margin of prothorax, an interrupted margin on the scutel, inferior edges of prothorax, a narrow marginal fascia on segments 1–2 of the abdomen, yellow. Feet black; tibiæ with a yellow line. Wings subhyaline, smoky; nerves black; 2d cubital cell much petiolate. Wing scales black.

Var. Smaller. Superior margin of metathorax not denticulate. Third abd. segment marginate with yellow; the 4th with two lateral yellow bordering marks. Wing scales preceded and followed by a yellow dot.—No yellow dot behind the eye.

♂. Clypeus rounded, black, coarsely punctured, its inferior border widely, but not deeply emarginate. The superior part yellow. Antennæ black, the scape with a yellow line; the hook black.

Hab. The hot parts of Mexico. 3 ♂. I caught the type in Pueblo Viejo, near Tampico; the variety is from Orizaba.

2. A. Brasiliensis SAUSS.—*A. Mexicano* affinis; at clypeo et thorace immaculatis; abdominis segmentis 30–50 tenuissime flavo-marginatis, lituris 4ⁱ et 5ⁱ interruptis; tarsis ferrugineis.

Alastor Brasiliensis SAUSS. Et. Vesp. III, 329, 211, pl. xvi, fig. 1, ♂ (1854).

Hab. Brazil.

Subgenus **ALASTOR** proprie dict.

(SAUSS. Vespides, III, 328.)

First abdominal segment without transverse suture.

The American species form the

Division **HYPALASTOR.**

(SAUSS. Vesp. III, 328.)

Form slender and cylindrical. Metathorax superiorly produced behind the post-scutel, then truncate; its margins sharp. (A group quite corresponding to Hypalastoroides.)

3. A. angulicollis SPIN.—Niger; pronoti margine antico, macula subalari, tegulis, fascia scutelli, margine postico abdominis segmentorum 1ⁱ, 2ⁱ, luteis; antennis pedibusque ferrugineis, his basi nigris; alis ferrugineis, apice griseis.—Long. 11 mm.

♀. Clypeo nigro, antennarum scapo nigro, flagello superne conspurcato.—♂. Clypeo luteo; scapo rufo superne puncto obscuro.

Odynerus angulicollis SPINOL. in Gay's Hist. fis. de Chile, Zool., VI, 261, 7 (1851).

Alastor angulicollis SAUSS. Et. Vesp. I, 258, 14, pl. xxi, fig. 7, ♂.

Hab. Chili.

4. A. melanosoma SAUSS.—Omnino ater, gracilis, cylindricus; clypeo ♀ grosse punctato, apice late subexciso, subbidentato; capite et thorace grosse punctatis; thorace antice latiore, pronoto biangulato, in margine antico et in lateribus marginato, metanoto valde rugoso, coarotato, valde pone post-scutellum producto; postice valde foveolato; margine circulari acutissimo superne fasso; margine infero bidentato (seu quadridentato); abdomine antice acute truncato.

Alastor melanosoma SAUSS. Et. Vesp. I, 259, 15, pl. xxi, fig. 8, ♀ (1852).

Total length, 14 mm.; wing, 10 mm.

Form slender and cylindrical. Forehead rather tumefied, parted by an obsolete groove; between the antennæ a vertical carina. Thorax much arched above, anteriorly. Prothorax rather concavely cut anteriorly, its margin hemmed; the hem forming a right angle on each side, along the lateral margin; the angles lamellate, inferiorly excavated. Scutel flattened, included behind by the metathorax, which is narrower than the rest of thorax, cylindrical or rather truncate-conical, being slightly narrowed posteriorly, much produced behind the post-scutel and sharply truncate vertically, and parted by a groove superiorly. Its posterior face circular, strongly, spherically excavated, smooth and finely punctured, parted by a fine groove; its superior and lateral margins forming together a sharp edge in the form of a very regular circle, not complete inferiorly and notched superiorly by a fissure; this sharp circular edge slightly reflexed in a sort of crest, but not crenulate; the inferior margins oblique, making by their conjunction with the circular margin on each side a lateral tooth, often notched so as to form a second inferior angle.¹

Abdomen elongate, cylindrical, quite sessile. First segment a little narrower than the second, rather elongate, very sharply truncate anteriorly, fitting into the concavity of the metathorax.

Head and thorax coarsely punctured; the metathorax very coarsely; abdomen quite finely and shallowly punctured; the second segment quite obsoletely channelled near its posterior margin, but not rugose.

Quite black; feet rather silky with fulvous reflections. Wings black, violaceous.

♀. Clypeus polished, very coarsely cribose, widely emarginate at the extremity, rather bidentate; the teeth subcarinate.

Res. a. diff.—Very closely allied to *A. singularis*.

Hab. Brazil (type in the author's collection).

Observation.—I first characterized this species as having its metathorax quadridentate, but the teeth in the lower part of metathorax are often obsolete, so that it is sometimes only bidentate.

5. *A. singularis* SAUSS.—Niger, capite et thorace crasse punctatis; *A. melanosomæ* affinis, at clypeo ♀ latiore quam longiore, apice truncato, haud emarginato; metanoti cantho acuto, orbiculari, infra

¹ Notched on one side and not on the other, in one specimen.

utrinque dente spiniformi armato, supra vix fisso, subdenticulato; abdominis primo segmento tenuissime flavo-marginato; tarsi rufi; alis infuscatis, costa obscuriore.

Alastor singularis SAUSS. Vespides, I, 259, 16, ♀ (1852).

Total length, 12 mm.; wing, 9 mm.

Closely allied to *A. melanosoma*; having the same form, but yet differing by the following characters:—

Head much swelled behind the eyes. The forehead not so convex, nor parted by a groove; no high carina between the antennæ, but rather an obsolete transverse wrinkle over their base. Metathorax not quite so rough; its circular ridges making nearly three-quarters of a circle; a little crenulate superiorly; its inferior ridges straight, forming, at the meeting of the circular ridge on each side, a distinct spine.

Black; first abdominal segment narrowly margined with yellow or fulvous. Tarsi ferruginous. Wings washed with fuscous; dark along the anterior margin, transparent, smoky posteriorly; the reflection more golden than violet.

Var. Second abdominal segment with a narrow submarginal yellow line, anterior margin of pronotum with a very narrow yellow margin (Rio).

♀. Clypeus rather transverse, nearly lozenge-shaped, more coarsely punctured, its apical margin truncate, not emarginate.

Hab. Brazil (1 ♀ in my collection).

Gen. **SMITHIA** SAUSS.

(Revue Zool. VII, 1855, 371.)

Abdomen petiolate; the first segment contracted in its whole length into a linear petiole.—*Second cubital cell* of the wing petiolate. (Forms slender; thorax elongate.)

This genus is formed from the petiolate *Alastor*. It bears the same relation to *Alastor* as *Eumenes* to *Odynerus*, as *Ctenochilus* to *Pterochilus*.

The only known species, *Sm. natalensis* Sauss, is from South Africa. The existence of this type in America has not yet been pointed out. I mention it here only to complete the classification of the solitary wasps.

APPENDIX.

SPECIES DUBLE.

THE following species I cannot discover, and it is very doubtful if they are solitary wasps.

- 1. Eumenes atrata** FABR. Syst. Piez., 287, 12.—America meridionalis.

If this species has the same form as *E. arcuatus*, to which Fabr. alludes, it may be the black variety of this from India, but Fabr. says; "*primo segmento infundibuliformi*," which is in entire contradiction with "*forte mera varietas*" of *E. arcuatus*.—It may be a *Montezumia*; *M. mortuorum*? or some allied species. The color of the wings is not given.

- 2. Eumenes formicaria** FABR. Syst. Piez., 288, 15.—Amer. merid.

This may be a *Montezumia* or a *Polistes*.

- 3. Vespa emarginata** GMEL. Ed. Linn., 2759, 26.—MUELLER Ed. Linn. Ins., II, 886, 26.—Clypeus emarginatus. Abdomen nigrum, petiolo utrinque dente instructo.—America—(Eumenes?).

- 4. V. cineraceus** FABR. Syst. Piez., 260, 37.—America (? *Alastor melanosoma* ??)

- 5. V. atrata** FABR. Syst. Piez. 260, 36.—Americæ insulis (a male), seems allied to *Alastor melanosoma*, but with hyaline wings.—*Montezumia*?

- 6. V. binotata** FABR. Syst. Piez., 266, 71.—America meridionalis.

Has some similarity to *Odynerus crypticus* Say.

- 7. V. dædala** LICHTENSTEIN, C. M. H. 203, n. 173—WEBER. Observ. Entom., 103, 8.—Nigra, odynero parietum paulo major; thoracis margine liturisque basi coeuntibus flavis; scutello flavo; abdomine cingulis 5 flavis; alis albis venis margineque antico fuscis.—America.



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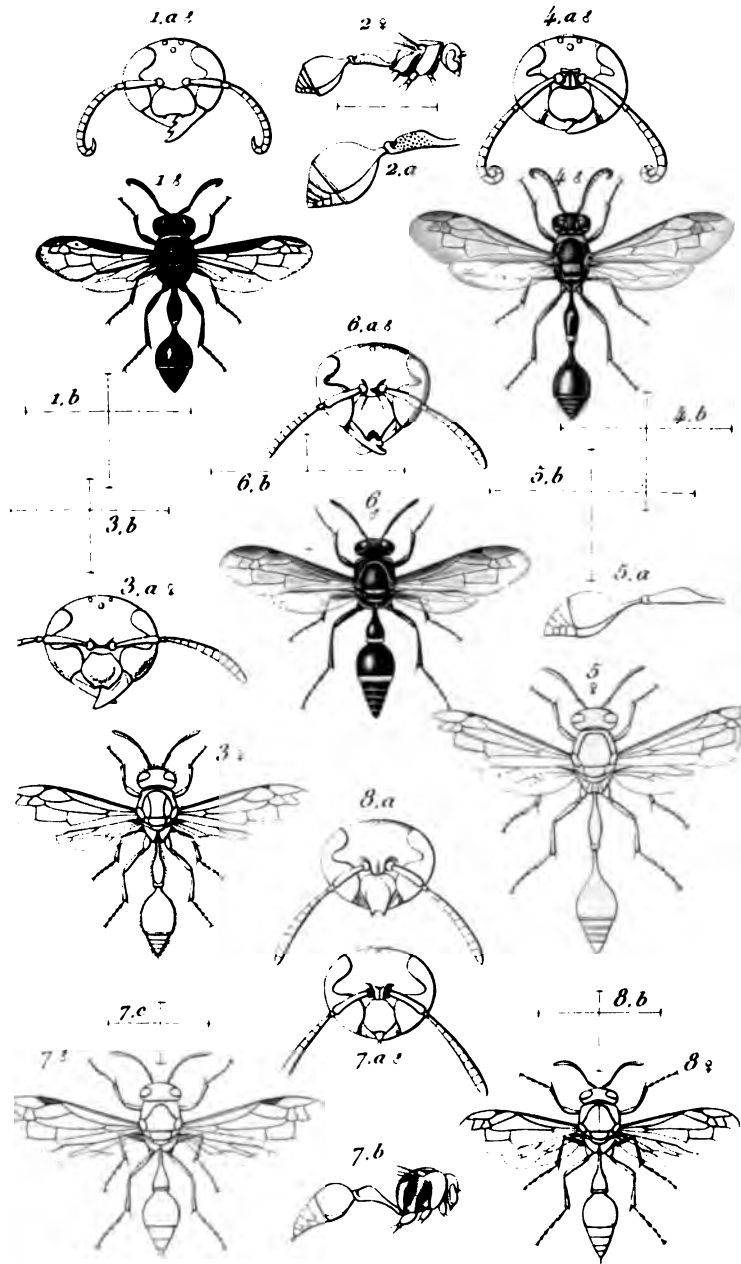
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EXPLANATION OF PLATE I.

- Fig. 1. **Zethus (Zethusculus) Aztecus** Sauss., ♂.
1a. Its head ♂ enlarged.
- Fig. 2. **Zethus (Zethusculus) spinosus** Sauss., ♀.
2a. Its abdomen enlarged.
- Fig. 3. **Zethus (Zethusculus) Montezuma** Sauss., ♀.
3a. Its head ♀ enlarged.
- Fig. 4. **Zethus (Didymogastra) Poeyi** Sauss., ♂.
4a. Its head ♂ enlarged.
- Fig. 5. **Zethus (Didymogastra) Chicotencatl** Sauss., ♀.
5a. Its abdomen enlarged, profile.
- Fig. 6. **Eumenes (Pachymenes) Santa-Anna** Sauss., ♀.
6a. Its head ♀ enlarged.
Obs. By error this figure is marked ♂ on the plate.
- Fig. 7. **Eumenes regulus** Sauss., ♀. (Div. O.)
7a. Its head ♂ enlarged.
7b. The profile enlarged.
- Fig. 8. **Eumenes Mexicanus** Sauss., ♀. (Div. O.)
8a. Its head ♀ enlarged.



ZETHUS — EUMENES.

Imp. Goussier, Paris



EXPLANATION OF PLATE II.

Fig. 9. **Montezumia Huasteca** *Sauss.*, ♂.

9a. Its head ♀ enlarged.

Fig. 10. **Montezumia Azteca** *Sauss.*, ♂.

10a. Its head ♂ enlarged.

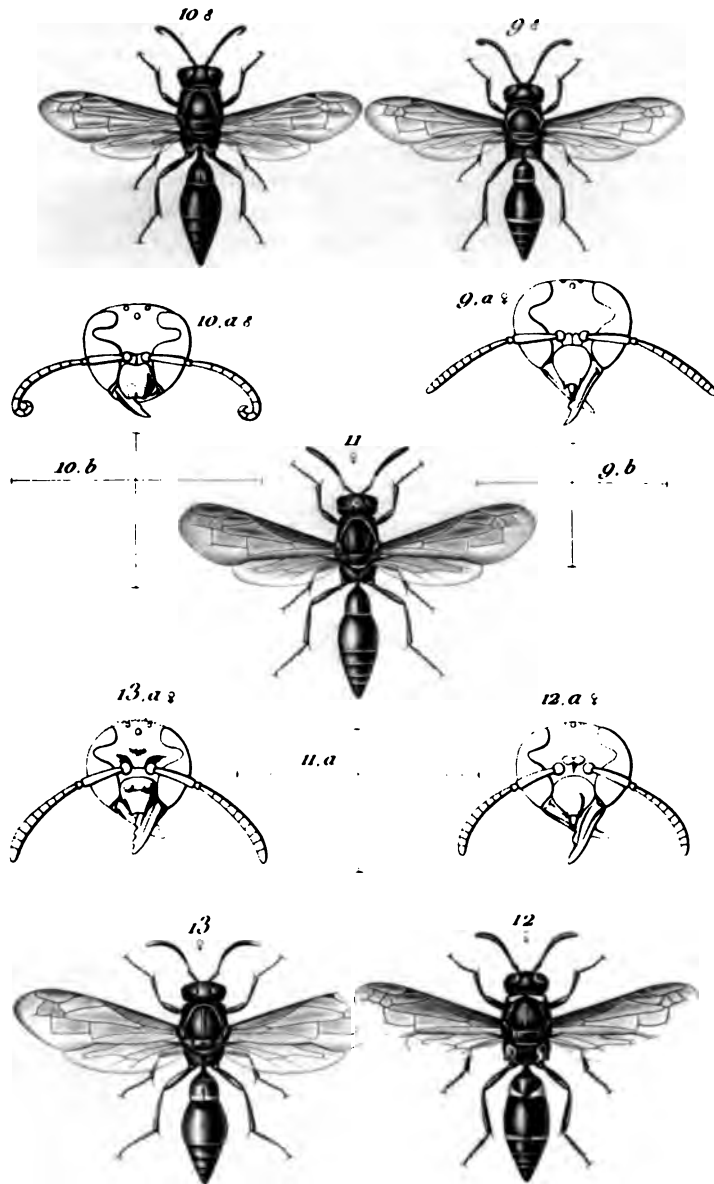
Fig. 11. **Montezumia Mexicana** *Sauss.*, ♀.

Fig. 12. **Monobia biangulata** *Sauss.*, ♀.

12a. Its head ♀ enlarged.

Fig. 13. **Nortonia Tolteca** *Sauss.*, ♀.

13a. Its head ♀ enlarged.



MONTEZUMA - MONOBIA - NORTONIA

Imp. Goss-Gros. Paris.

1100

EXPLANATION OF PLATE III.

Fig. 14. **Odynerus bidens** *Sauss.*, ♂, var.

14a. Its head ♂ enlarged.

Fig. 15. **Odynerus Iturbidi** *Sauss.*, ♂.

15a. Its head ♂ enlarged.

Fig. 16. **Odynerus arvensis** *Sauss.*, ♀.

16a. Its clypeus ♀ enlarged.

Fig. 17. **Odynerus Californicus** *Sauss.*, ♀.

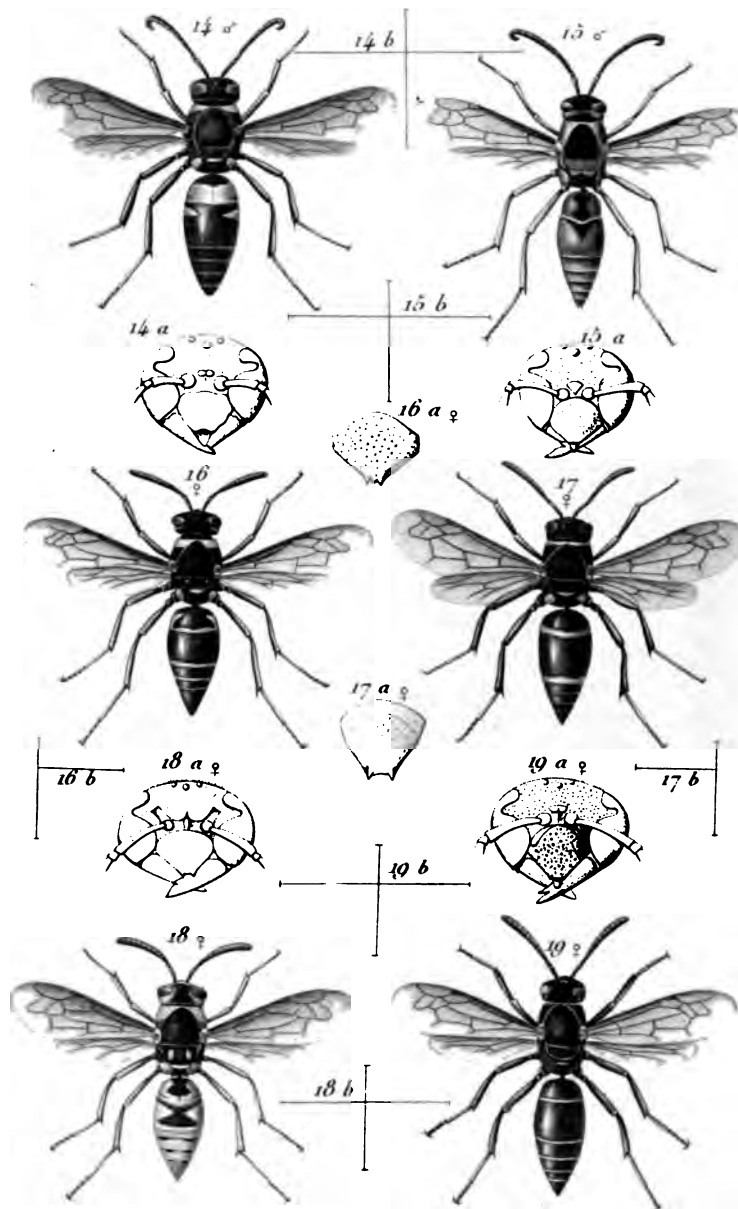
17a. Its clypeus ♀ enlarged.

Fig. 18. **Odynerus sulfureus** *Sauss.*, ♀.

18a. Its head ♀ enlarged.

Fig. 19. **Odynerus leucomelas** *Sauss.*, ♀.

19a. Its head ♀ enlarged.



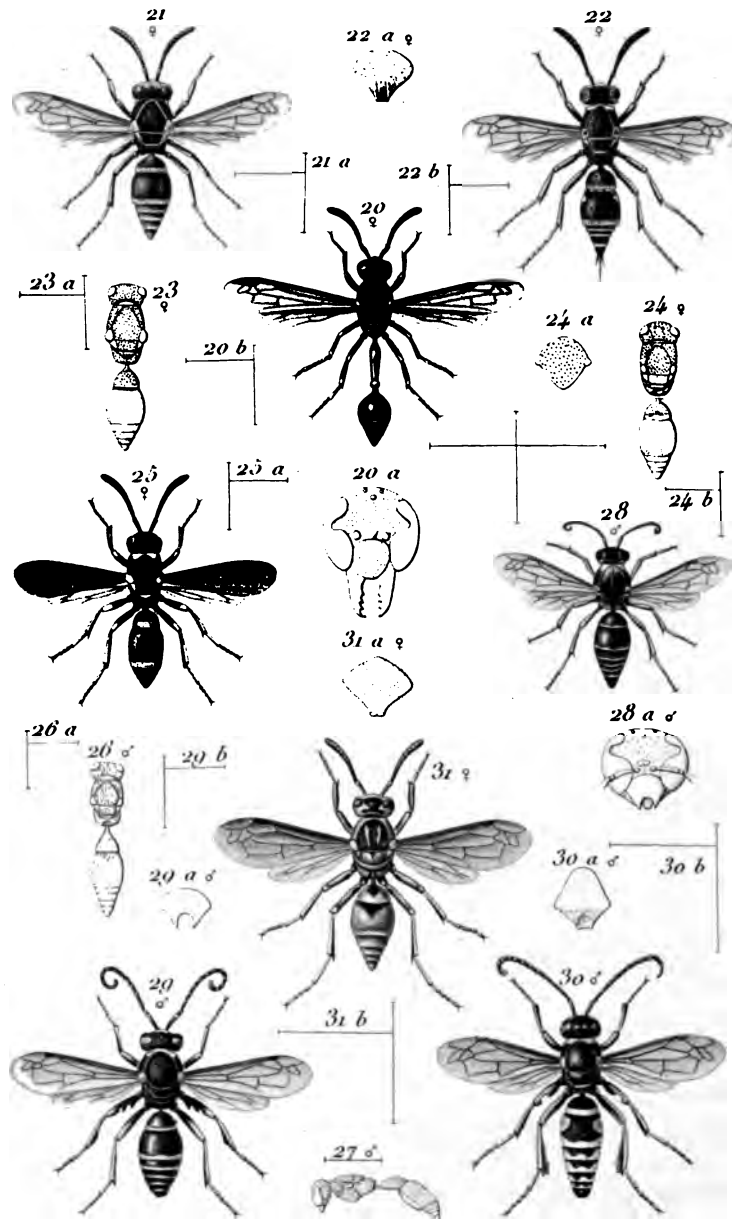
ODYNERUS

Imp long-term. Pers



EXPLANATION OF PLATE IV.

- Fig. 20. **Labus Sicelianus** *Sauss.*, ♀.
20a. Its head enlarged.
- Fig. 21. **Odynerus Otomitus** *Sauss.*, ♀.
- Fig. 22. **Odynerus (Stenodynerus) pedestris** *Sauss.*, ♀.
22a. Its clypeus enlarged.
- Fig. 23. **Odynerus Totonacus** *Sauss.*, ♀.
- Fig. 24. **Odynerus Zendalus** *Sauss.*, ♀.
24a. Its clypeus enlarged.
- Fig. 25. **Odynerus (Stenodynerus) perennis** *Sauss.*, ♀.
- Fig. 26. **Odynerus coyotus** *Sauss.*, ♂.
- Fig. 27. **Odynerus Tacubayæ** *Sauss.*, ♂.
- Fig. 28. **Odynerus bacuensis** *Sauss.*, ♂.
28a. Its head ♂ enlarged.
- Fig. 29. **Odynerus (Epiponus) dilectus** *Sauss.*, ♂.
29a. Its clypeus ♂ enlarged.
- Fig. 30. **Odynerus (Epiponus) denticulatus** *Sauss.*, ♂.
30a. Its clypeus ♂ enlarged.
- Fig. 31. **Pterochilus mexicanus** *Sauss.*, ♀.
31a. Its clypeus ♀ enlarged.



LABUS — ODYNERUS — PTEROCHILUS

Imp. Goussier, Paris

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

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C A T A L O G U E

OF THE

FISHES

OF

THE EAST COAST OF

N O R T H A M E R I C A .

BY

THEODORE GILL, M.D., PH.D.



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ADVERTISEMENT.

THE following Catalogue of the Fishes of the east coast of North America was prepared by Dr. Theodore Gill as an Appendix to the report of the U. S. Commissioner of Fish and Fisheries for 1871-2.* Numerous applications having been made for separate copies of the catalogue, it is now issued as one of the publications of the "Smithsonian Miscellaneous Collections."

JOSEPH HENRY,
Secretary S. I.

* United States Commission of Fish and Fisheries.—Part I.—Report on the Condition of the Sea Fisheries of the South Coast of New England in 1871 and 1872. By Spencer F. Baird, Commissioner. — With supplementary papers. — Washington: Government Printing Office. 1873. (Pp. 779—822=pp. 1—44 of Catalogue.)

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CATALOGUE OF THE FISHES OF THE EAST COAST OF NORTH AMERICA.

BY THEODORE GILL.

SCOPE OF CATALOGUE.

The following catalogue may be considered as a new edition of a "Catalogue of the Fishes of the Eastern Coast of North America from Greenland to Georgia," published in 1861, inasmuch as it covers the same ground; but, as it has been entirely recast, and expresses the results of the author's own studies as well as those of others, since the date of its publication, it is essentially a new work.

LITERATURE.

The literature of American ichthyology is quite voluminous, but it is in great part represented in the periodical literature (publications of learned societies and scientific magazines) and by monographic essays or isolated descriptions of genera and species. Exclusive of such articles, there are three principal classes of publications which contain descriptions or references to more or less of the species described:

1. Works on fishes in general.
2. Works on American fishes in general.
3. Works on faunas, or relating to states, &c.

1. The general works on fishes, commencing with Willoughby and Ray, and continued by Artedi, (1738,) Klein, (1740-'49,) Linné, (1748-68,) Bloch, (1782-'95,) Hany, (1787,) Bonnaterre, (1788,) Gmelin, (1788,) Walbaum, (1792,) Lacépède, (1798-1803,) Bloch and Schneider, (1801,) Shaw, (1803-'04,) Cuvier and Valenciennes, (1828-'49,) A. Duméril, (1865-'70,) and Günther, (1859-'70,) successively included the species known to them and described by previous naturalists, and the last works include, on the whole, the best descriptions (because comparative) of many of the species. All these works are by foreign authors*.

2. The general works on North American fishes, in whole or part, are by De Kay, Storer, and Gill.

3. The more restricted faunal works, or those relating to specific districts and States, are more numerous, but of very unequal value, some containing descriptions of all the species as well as the including groups.

* A complete bibliographical catalogue of these works is given by the author of the present article in an "Arrangement of the Families of Fishes," published by the Smithsonian Institution.

2 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

while others are simple lists of species, to a great degree dependent for their value on the reputation of their authors for knowledge and reliability.

DOUBTFUL SPECIES.

The names of many of the species are still very unsettled or require confirmation. The doubts arise principally from two sources :

1. Erroneous identification with previously-described species.
2. Erroneous differentiation from previously-described species.

Both categories of errors mostly result from two causes :

1. From default of actual comparison of specimens representing the different forms.

2. From erroneous valuation of certain similarities or differences which may exist between the respective forms ; in some cases (*a*) the differential characters having been overlooked or subordinated to the common characters, while in others (*b*) differences which may be observed on comparison of isolated specimens are not confirmed by larger series, or fail to apply to forms from intermediate regions.

As might be expected from these considerations, the doubts affect chiefly (1) the species found in the temperate or arctic regions, and which are represented by forms in both hemispheres ; and (2) those of large size, represented also in both hemispheres, or inhabitants of the open sea.

The author has not at present the means to solve all these doubts for others or to satisfy himself. While the material for the American forms is often ample, that for the European or exotic types (chiefly in the case of the large sharks, rays, and scombroids) is, in several cases, insufficient. Therefore he has preferred to retain the names given to the American forms as distinct species, although he is inclined to believe that they will be eventually found to be co-specific with other forms. For the guidance of others, these doubtful forms are indicated in the following catalogue, the nature of the doubt being distinguished, whether referring to the more or less dubious distinction of the nominal species, (*d. s.*) or whether to the dubious identification of the form with another, (*d. @ s.*) Although these stigmas are cast on a number of the names admitted, it is not probable that future comparisons will necessitate changes for most or even a large proportion. Nevertheless, the desirability of a settlement of the doubts one way or the other is not the less decided.

The opportunity for the settlement of some of these questions at least will, however, soon be furnished, as specimens of the desirable species have already been promised, or are on their way from Europe, and in a future report the results of the comparisons may be made known. To the efforts of the Commissioner of Fisheries we have been indebted for the means of determining some of the doubtful questions earlier than would otherwise have been possible, and we will soon have the means

of determining others. And as these questions involve several of the species most important in an economical point of view, and as their determination may further throw much light on their geographical distribution and their consequent relations to each other, physiological as well as anatomical, their solution will be no slight boon to science.

CLASSIFICATION.

The classification adopted is that proposed by the author in his "Arrangement of the Families of Fishes," (1872,) published by the Smithsonian Institution, and differs in many respects from that employed in the "Catalogue of the Fishes of the Eastern Coast of North America," (1861.) While, however, it is believed to be a much better exponent of the real relations of the various forms, it is far from perfect, and little attempt has been made to exhibit the forms in a natural sequence; but, to some extent, the task has been attempted. It is necessary to add, in further explanation, that the series is an *inverted ascending one*, (and not a true descending one);—that is, commencing with the most generalized (or lowest) form, the various types have been successively approximated in accordance with their affinities (or supposed affinities) to the preceding forms; but, inasmuch as almost universal usage has accustomed the ichthyologist to look for the specialized (or highest) forms first, they have been so exhibited in the catalogue, subject to the modifications the mode of procedure adopted entails.

NUMBER OF SPECIES.

It will be perceived that only about 351 nominal species are enumerated in the present catalogue, while 394 were given in the catalogue published in 1861, and yet about 50 species have been added since that time. The diminished number is the result of reduction and reference of many nominal species to their proper types, and it is due to the author to state that the necessity for most of those changes was foreseen by him,* and that they were either first effected or the correctness thereof first demonstrated by himself in various articles published from time to time in scientific journals. The limit of reduction, so far as respects species represented on the coast, has now been nearly (but not quite) reached; but the ultimate reductions, already hinted at, will doubtless affect, to some inconsiderable extent, the sum-total of the number of fishes by the reduction of nominal American species to forms of those previously described from elsewhere.

FAUNAS.

The geographical ranges of the marine species of animals might be best indicated by the names of the faunal regions admitted for the sev-

* "The number of species described in the catalogue [of 1861] nominally amounts to 394. It is probable that when the species are thoroughly investigated, the number will be considerably reduced, and that many now retained with hesitation as distinct will be identified with previously known ones."—(Gill, op. cit., 1861, p. 23.)

eral subdivisions of the eastern American coast by various naturalists, but especially Dana, Packard, and Verrill.*

Five such faunas are embraced in the scope of the catalogue, and have been designated by the following names:

1. ARCTIC FAUNA, (properly realm,) which embraces the entire polar region, and extends southward to a yet undetermined distance, but not as far as Newfoundland. Inasmuch, however, as most of the fishes found in the Greenland seas have not been noted as occurring elsewhere, it would be advisable to be specific as to their habitats.

2. SYRTENSIAN FAUNA, distinguished by Packard from the Arctic. It includes the coasts of Labrador and Newfoundland, but its limits have not been well defined.

3. ACADIAN FAUNA, named by Lütken, but first distinguished as the Nova Scotian by Dana. It extends from the Syrtensian southerly to Cape Cod, close to the shore, but pushes farther southward in deeper water, and at a distance from the shore.

4. VIRGINIAN FAUNA, bounded to the north by Cape Cod and to the south by Cape Hatteras.

5. CAROLINIAN FAUNA, extending from Cape Hatteras southward to the northern limits of the coral-reefs of Florida.

It must also be borne in mind that the general character of the coast of the northern faunal areas is quite different from that of the southern ones, the former having a rock-bound shore-line, while the latter (Virginian and Carolinian) have chiefly an areniferous one, with few rocks, and the distinctive peculiarities of the northern and southern faunas are considerably increased by these physical differences of the coast.

Such are the designations that might be most desirable in a scientific treatise. In order, however, to avoid all cavil, the circumlocutory form of designating the limits of the faunas for each species has, at the instance of the Commissioner of Fisheries, been adopted. But it must be understood that many of the species have not been detected at the different points within the limits specified, and may have been only found once. In all cases, however, (except when specially designated as "accidental" or "occasional,") the species, in all probability, can be found at fitting stations within the described limits.

POPULAR NAMES.

The popular names, so far as known, have been added after the scientific ones, and in a number of cases, at the request of the Commissioner of Fisheries, names for popular use have been framed for species having no other distinctive ones. These new terms have been mostly derived from names applied to related forms in this country or England, which are used rather in a generic than specific sense, and with the addition of a

* Verrill (Addison E.) *Revision of the Polypti of the Eastern Coast of the United States* (December, 1863). <Memoirs read before the Boston Society of Natural History, vol. 1, p. 41.

qualifying adjective for the specific appellatives. It must always be borne in mind, however, that popular names can never be relied upon for the determination of the species, as they vary with locality, and are applied in the most arbitrary manner. Thus, the familiar *Pomatomus saltatrix* is generally known as the "blue-fish" at the principal centers of population, (New York, &c.,) but is also called "horse-mackerel," (at Newport, and Beesley's Point, New Jersey,) "tailor," (at Philadelphia and along portions of the southern coast,) "white fish," "snap-mackerel," and in the young state, "skip-jack;" while, on the other hand, the name "blue-fish" is applied to the squeteague, or weak-fish, (*Cynoscion regalis*,) at Beesley's Point; "horse-mackerel" is transferred to the tunny, along the Massachusetts coast; "tailor" is the name given to the fall-herring, (*Pomolobus medliceris*,) at Washington, and the designation "white-fish" is best known in connection with the *coregoni*. Nor are these exceptional cases. Many fishes have still more varied names along the several parts of the coast, and certain appellatives (such as sun-fish, black-fish, pike, salmon, trout, &c.) are used with still greater latitude than any of those specified.

Under such circumstances it must be obvious to all that, in order to avoid great circumlocution and preliminary explanation, and to insure definiteness of conception, names that are used only in one rigorous sense, and respecting the application of which there can be no doubt, must be *desiderata*, and such conditions are only fulfilled by the scientific names. At the same time, it is undoubtedly desirable that the applications of the popular names along the different portions of the coast shall be ascertained, and therein an explanation may be found of the conflicting accounts given of the different species, the confusion in which the histories of some species is involved being evidently due, in part, to the confusion of names and the misapplication of accounts induced by their diverse applications. The unraveling of this confusion will be one of the objects of the Commissioner, and on a future occasion the varying names and applications of names along different parts of the coast will probably be given in connection with the different species.

I.—TABLE OF THE HIGHER GROUPS.

CLASS A.—PISCES OR TRUE FISHES.

SUB-CLASS I.—TELEOSTEI.

ORDER 1.—PEDICULATI.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.
	Lophioidea	Maltheidae (1)	Maltheinae	<i>Malthe</i> <i>Cur.</i>
		Lophiidae (2)	.....	<i>Lophius</i> (<i>Linn.</i>) <i>Cur.</i>
	Antennarioidea . .	Ceratiidae (3)	.....	<i>Himantolophus</i> <i>Reinh.</i>
				<i>Oncirodea</i> <i>Lütken.</i>
				<i>Ceratias</i> <i>Kroyer.</i>
		Antennariidae . (4)	Antennariinae . .	<i>Pterophryne</i> <i>Gill.</i>

ORDER 2.—PLECTOGNATHI.

Gymnodontes	Orthagoriscoides .	Orthagoriscidae (5)	Molacanthinae . .	<i>Molacanthus</i> <i>Sw.</i>
			Orthagoriscinae . .	<i>Mola</i> <i>Cur.</i>
	Tetrodontoidea . .	Diodontidae . . . (6)	Diodontinae	<i>Chilomycterus</i> <i>Bibron.</i>
				<i>Trichodiodon</i> <i>Bleeker.</i>
		Tetrodentidae . (7)	Tetrodontinae . .	<i>Tetrodon</i> <i>Linn.</i>
				<i>Chilichthys</i> <i>Müll.</i>
Ostracoderma		Ostraciontidae . (8)	Ostraciontinae . .	<i>Lactophrys</i> <i>Sacina.</i>
Scleroderma	Balistoidea	Balistidae (9)	Monacanthinae . .	<i>Alutera</i> <i>Cur.</i>
				<i>Ceratacanthus</i> <i>Gill.</i>
				<i>Stephanolepis</i> <i>Gill.</i>
			Balistinae	<i>Ballistes</i> <i>Linn.</i>

ORDER 3.—LOPHOBRANCHII.

Syngnathi	Hippocampidae (10)	Hippocampinae . .	<i>Hippocampus</i> <i>Cur.</i>
	Syngnathidae . (11)	Syngnathinae . . .	<i>Syngnathus</i> <i>Linn.</i>

ORDER 4.—HEMIBRANCHII.

	Centriscoides . . .	Centriscidae . . (12)	.....	<i>Centriscus</i> <i>Linn.</i>
	Anlostomoidea . .	Fistulariidae . (13)	.....	<i>Fistularia</i> <i>Linn.</i>
	Gasterosteoides . .	Gasterosteidae (14)	Gasterosteinae . .	<i>Gasterosteus</i> (<i>L.</i>) <i>Berr.</i>
				<i>Pygosteus</i> , <i>Brev.</i>
				<i>Apeltes</i> (<i>De Kay</i>) <i>Brev.</i>

ORDER 5.—TELEOCEPHALI

Sub-order.	Super-family.	Family.	Sub-family.	Genus.		
Heterosomata...		Soleidæ (15)	Plagusinæ.....	Plagusia <i>Cuv.</i>		
			Soleinæ.....	Achirus <i>Lac.</i>		
		Pleuronectidæ (16)	Pleuronectinæ ..	Euchalarodus <i>Gill.</i>		
				Pseudopleuronectes <i>Blekr.</i>		
				Myxopsetta <i>Gill.</i>		
				Limanda <i>Gottsche.</i>		
				Pleuronectes <i>Linn.</i>		
			Glyptocephalus <i>Gottsche.</i>			
			Rhombinæ.....	Lophopsetta <i>Gill.</i>		
				Citharichthys <i>Bleeker.</i>		
			Hippoglossinæ ..	Hippoglossoides <i>Gottsche.</i>		
				Pomatopsetta <i>Gill.</i>		
		Chænopsetta <i>Gill.</i>				
			Hippoglossus <i>Cuv.</i>			
			Reinhardtius <i>Gill.</i>			
		Macruridæ... (17)	Macrurus <i>Bl.</i>			
Jugulares.....	Gadoidea.....	Gadidæ (18)	Gadinæ.....	Boreogadus <i>Günth.</i>		
				Pollachius <i>Nils.</i>		
				Gadus (<i>Arctid.</i>) <i>Gill.</i>		
				Microgadus <i>Gill.</i>		
				Melanogrammus <i>Gill.</i>		
			Phycinæ.....	Phycis <i>Raf.</i>		
				Trophycis <i>Gill.</i>		
			Lotinæ.....	Molva (<i>Flem.</i>) <i>Nils.</i>		
			Ciliatinæ.....	Onos <i>Risso.</i>		
				Rhinonemus <i>Gill.</i>		
				Ciliata <i>Couch.</i>		
			Brosminæ.....	Brosmius <i>Cuv.</i>		
			Merluccidæ... (19)	Merluccinæ.....	Merluccius <i>Raf.</i>	
			Ophidioidæ.....	Ophidiidæ.... (20)	Ophidium (<i>Arctid.</i>) <i>Linn.</i>	
			Brotuloidæ.....	Brotulidæ.... (21)	Bythitinae.....	Bythites <i>Reinh.</i>
			Lycodoidea.....	Lycodidæ (22)	Gymnelinæ.....	Gymnelis <i>Reinh.</i>
Lycodinae.....	Lycodes <i>Reinh.</i>					
Zoarclinæ.....	Zoarces <i>Cuv.</i>					
Acanthopteri....	Blennioidea.....	Cryptacanthidæ (23)		Cryptacanthodes <i>Storer.</i>		
				Etmopterus <i>Gill.</i>		
		Stichæidæ.... (24)		Sticheus <i>Reinh.</i>		
				Leptoclinus <i>Gill.</i>		
				Anisarchus <i>Gill.</i>		
		Lampanyctus <i>Reinh.</i>				

ORDER 5.—TELEOCEPHALI—Continued.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.
Acanthopteri ..	Blennioidea	Stichæidæ (24)	.....	<i>Leptoblennius</i> Gill.
				<i>Centroblennius</i> Gill.
		Xiphidiontidæ .. (25)	.....	<i>Muraenoides</i> Lac.
		Anarrhichadidæ. (26)	.....	<i>Anarrhichas</i> L.
		Blenniidæ (27)	Blenniinæ	<i>Blennius</i> Linn.
				<i>Hypleurochilus</i> Gill.
				<i>Pholis</i> (Artedi) Cuv.
				<i>Hypsoblennius</i> Gill.
				<i>Chasmodes</i> Cuv. & Val.
	Patrachoidæ ...	Batrachidæ (28)	.....	<i>Batrachus</i> Linn.
	Uranoscopoidea ..	Uranoscopidæ .. (29)	.....	<i>Astroscopus</i> <i>Ireroort</i> .
	Cyclopteroidea ..	Cyclopteridæ .. (30)	Cyclopterinæ ..	<i>Cyclopterus</i> Linn.
				<i>Eumicrotremus</i> Gill.
		Liparididæ (31)	Liparidinæ	<i>Liparis</i> (Art.) Linn.
				<i>Actinocybir</i> Gill.
			Careproctinæ ..	<i>Careproctus</i> Kroyer.
	Gobioidea	Gobiidæ (32)	Gobiinæ	<i>Gobiosoma</i> Girard.
				<i>Gobius</i> (Linn.) Gill.
			Eleotridinæ	<i>Dormitator</i> Gill.
	Cottoidea	Triglidæ (33)	Dactylopterinæ ..	<i>Dactylopterus</i> Lac.
			Triglinæ	<i>Prionotus</i> Lac.
				<i>Trigla</i> Linn.
		Agonidæ (34)	Leptagoninæ	<i>Aspidophoroides</i> Lac.
			Agoninæ	<i>Agonus</i> Bloch.
		Cottidæ (35)	Cottinæ	<i>Cottus</i> (Linn.)
				<i>Oncocottus</i> Gill.
				<i>Gymnacanthus</i> Sw.
				(<i>Cottus</i>) Reinb.
				<i>Triglops</i> Reinb.
		Hemitriptidæ.. (36)	.....	<i>Hemitripterus</i> Cuv.
		Scorpenidæ (37)	Scorpeninæ	<i>Sebastes</i> (Cuv.) Gill.
				<i>Scorpena</i> Linn.
	Labroidea	Labridæ (38)	Labrinæ	<i>Tautoga</i> (Mitch.) Bleeker.
				<i>Tautoglabrus</i> Guather.
			Xyrichthinæ	<i>Xyrichtys</i> Cuv.
			Julidinae	<i>Cherajulis</i> Gill.
			Pomacentridæ (38a)	<i>Glyphidodon</i> Lac.
	Polynematoidea ..	Polynemidæ (39)	.....	<i>Trichidion</i> (Klein.) Gill.
	Teuthidoidea ..	Teuthididæ (40)	.....	<i>Acanthurus</i> Forskal.
	Chetodontoidæ ..	Chetodontidæ.. (41)	Chetodontinæ ..	<i>Sarothrodus</i> Gill.
				<i>Holacanthus</i> Lac.

ORDER 5.—TELEOCEPHALI—Continued.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.
Acanthopteri	Scombroidea	Xiphiidae (42)	Xiphiinae	<i>Xiphias</i> Linn.
			Tetrapturinae ...	<i>Tetrapturus</i> Raf. <i>Histiophorus</i> Lac.
		Trichiuridae .. (43)	Trichiurinae	<i>Trichiurus</i> Linn.
		Scombridae ... (44)	Scombrinae	<i>Scomber</i> (Linn.) Ows.
			Oreyninae	<i>Sarda</i> Cuv. <i>Oreynus</i> (Ouv.) Gill.
				<i>Cybium</i> Cuv.
		Carangidae ... (45)	Vomerinae	<i>Vomer</i> Ouw. <i>Selene</i> (Lac.) Brss. <i>Argyrosus</i> Lac.
			Caranginae	<i>Decapterus</i> Bleeker. <i>Trachurope</i> Gill. <i>Paratractus</i> Gill. <i>Carangus</i> (Girard) Gill. <i>Carangops</i> Gill. <i>Blepharichthys</i> Gill.
			Chloroscombrinae	<i>Chloroscombrus</i> Girard.
			Trachynotinae ...	<i>Trachynotus</i> Lac.
			Centronotinae ...	<i>Naucrates</i> (Raf.) Gill. <i>Zonichthys</i> (Sw.) Gill. <i>Halatractus</i> Gill.
		Coryphaenidae (46)	Coryphaeninae ..	<i>Coryphaena</i> Linn.
		Stromateidae . (47)	Centrolophinae ..	<i>Palinurichthys</i> Gill.
			Stromateinae	<i>Poronotus</i> Gill. <i>Peprilus</i> Cuv.
		Bramidae (48)	Pteraclinae	<i>Pteraclia</i> Gron.
		Lamprididae .. (49)		<i>Lampris</i> (Retz.)
		Zenidae (50)		<i>Zenopsis</i> Gill.
	Mulloidae	Mullidae (51)		<i>Mullus</i> Linn.
	Beryoidea	Berycidae (52)	Holocentrinae ...	<i>Holocentrum</i> Bloch.
	Sciænoidae	Sciænidæ (53)	Otolithinae	<i>Cynoscion</i> Gill.
			Haploidenotinae ..	<i>Pogonias</i> Lac.
			Liostominae	<i>Liostomus</i> Lac.
			Sciæninae	<i>Stelliferus</i> (Ouv.) Stark. <i>Bairdiella</i> Gill. <i>Sciaenops</i> Gill. <i>Menticirrhus</i> Gill. <i>Micropogon</i> Ows.
			Lariminae	<i>Larimus</i> Ows. & Val.
				<i>Eucinostomus</i> B. & G.
	Gerridae	Gerridae (54)		

ORDER 5.—TELEOCEPHALI—Continued.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.	
Acanthopteri ...	Percoidae	Pimalepteridæ (53)	.....	Pimalepterus <i>Lac.</i>
		Sparidæ (56)	Sparinæ	Lagodon <i>Holb.</i>	
					Archosargus <i>Gill.</i>
					Stenotomus <i>Gill.</i>
					Sparus (<i>Linna.</i>) <i>Bon.</i>
		Pristipomatidæ (57)	Lutjaninæ	Lutjanus (<i>Bl., Schn.</i>) <i>Gill.</i>	
			Pristipomatinae	Hæmulon <i>Cuv.</i>	
				Orthopristis <i>Girard.</i>	
				Pristipoma <i>Cuv.</i>	
				Anisotremus <i>Gill.</i>	
		Serranidæ (58)	Rhypticinæ	Promicropterus <i>Gill.</i>	
			Serraulnæ.....	Hyporthodus <i>Gill.</i>	
				Epinephelus <i>Gill.</i>	
				Trisotropis <i>Gill.</i>	
				Centropristis <i>Cuv.</i>	
				Triloburus <i>Gill.</i>	
				Diplectram <i>Holbr.</i>	
				Dules <i>Cuv.</i>	
			Labracidæ ... (59)	Roccus <i>Gill.</i>
					Morone <i>Gill.</i>
Incertæ sedis ...	Ammodytoidæ ..	Ephippiidæ .. (60)	.....	Parephippus <i>Gill.</i>
		Lobotidæ.... (61)	.....	Lobotes <i>Cuv.</i>
		Pomatomidæ . (62)	.....	Pomatomus <i>Lac.</i>
		Elacatidæ (63)	.....	Elacate <i>Cuv.</i>
		Chilodipteridæ (64)	Apogoninæ	Apogonichthys <i>Bleeker.</i>	
	Priacanthoidæ ..	Priacanthidæ (65)	.....	Priacanthus <i>Cuv.</i>
				Pseudopriacanthus <i>Bleker</i>	
	Ammodytoidæ ..	Ammodytidæ (66)	Ammodytinæ ..	Ammodytes <i>Linna.</i>	
			Argyrotæninæ ..	Argyrotænia <i>Gill.</i>	
	Echeneidoidea ..	Echeneididæ . (67)	.....	Leptecheneis <i>Gill.</i>
			Rhombochirus <i>Gill.</i>		
			Remoropsis <i>Gill.</i>		
			Echeneis (<i>Linna.</i>) <i>Gill.</i>		
Sphyrænoidea...	Sphyrænidæ . (68)	.....	Sphyræna <i>Bloch.</i>	
Percosoces	Mugiloidea	Mugilidæ (69)	.....	Mugil <i>Linna.</i>
		Atherinidæ .. (70)	.....	Chirostoma (<i>Su.</i>)
				Atherina (<i>Linna.</i>)	
Synentognathi ..		Belonidæ (71)	.....	Belone <i>Cuv.</i>
		Scomberesocidæ (72)	Exocætinæ.....	Exocætus <i>Linna.</i>	
				Halocypselus <i>Weinmnd(d.g.)</i>	
				Cypselurus <i>Su. (d.g.)</i>	

ORDER 5.—TELEOCEPHALI—Continued.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.
Synentognathi		Scomberesocidæ (72)	Hemirhamphinae	<i>Euleptorhamphus</i> Gill. <i>Hemiramphus</i> Cuv. <i>Scomberesocinae</i> <i>Scomberesox</i> Lac.
Haplomi	Cyprinodontoidea	Cyprinodontidæ (73)	Cyprinodontinae	<i>Cyprinodon</i> Lac. <i>Hydrargyrinae</i> <i>Micristius</i> Gill. <i>Fundulus</i> Lac. <i>Hydrargyra</i> Lac.
Isospondyli	Stomiatoidea	Stomiatidæ (74)	Chauliodontinae	<i>Malacosteus</i> Ayres.
			Stomiatinae	<i>Stomias</i> Cuv.
		Scopelidæ (75)	Scopelinae	<i>Scopelus</i> Cuv.
			Coccolinae	<i>Maurolencus</i> Cocco.
		Synodontidæ . (76)		<i>Trachinocephalus</i> Gill. <i>Synodus</i> (Gron.) Bl. & Schn.
	Salmonoidea	Microstomidæ (77)	Argentininae	<i>Mallotus</i> Cuv. <i>Osmerus</i> Artdi.
			Microstominae	<i>Microstoma</i> Risso.
		Salmonidæ (78)	Salmoninae	<i>Salmo</i> Linn.
	Paralepidoidæ	Paralepididæ . (79)		<i>Paralepis</i> Risso.
	Albuloidæ	Albulidæ (80)		<i>Albula</i> Gronow.
	Elopoidea	Elopidæ (81)		<i>Elops</i> Linn. <i>Megalops</i> Lac.
	Clupeoidea	Dorosomieridæ (82)		<i>Etrumeus</i> Bleeker.
		Clupeidæ (83)	Clupeinae	<i>Brevoortia</i> Gill. <i>Alosa</i> Cuv. <i>Opisthonema</i> Gill. <i>Pomolobus</i> (Raf.) Gill. <i>Clupea</i> Linn. <i>Dorosoma</i> (Raf.) Gill. <i>Engraulis</i> Cuv.

ORDER 6.—NEMATOGNATHI.

	Siluroidea	Siluridæ (86)	Ariinae	<i>Ælurichthys</i> Bd. & Gir. <i>Ariopsis</i> Gill.
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ORDER 7.—APODES.

Enchelycephali		Congridæ (87)	Congrinae	<i>Conger</i> Cuv.
		Anguillidæ (88)		<i>Anguilla</i> Thunberg.
		Saccopharyngidæ (89)		<i>Saccopharynx</i> Mitch.

SUB-CLASS II.—GANOIDEA.
SUPER-ORDER CHONDROSTEI.

ORDER 8.—GLANIOSTOMI.

Sub-order.	Super-family.	Family.	Sub-family.	Genus.
		Accipenseridæ (90)	Accipenserinæ ..	Accipenser (<i>Linn.</i>)

CLASS B.—ELASMOBRANCHII.

SUPER-ORDER PLAGIOSTOMI.

ORDER 9.—RAIÆ.

<i>Musticura</i>	<i>Myliobatoidea</i>	Cephalopteridæ (91)		<i>Ceratoptera</i> Müll. & Henle.
		Myliobatidæ . (92)	Etobatinae	<i>Etobatis</i> Müll. & Henle.
			Myliobatinae	<i>Rhinoptera</i> Cur.
	<i>Trygonoidea</i>	Trygonidæ . (93)	Pteroplateinae	<i>Myliobatis</i> Dum.
			Trygoninae	<i>Pteroplatea</i> Müll. & Henle.
<i>Sarcura</i>	<i>Torpedinoidea</i>	Torpedinidæ . (94)	Torpedininae	<i>Trygon</i> (Adanson) Cur.
	<i>Rainoidea</i>	Rainidæ . . . (95)	Raininae	<i>Torpedo</i> Dum.
		Pristidæ . . . (96)		<i>Raia</i> (<i>Linn.</i>)
				<i>Pristis</i> Lath.

ORDER 10.—SQUALI.

<i>Rhina</i>		Squatinaidæ . (97)		<i>Squatina</i> Dum.
	<i>Lamna</i>	Cetorhinidæ . (98)		<i>Cetorhinus</i> Blainv.
		Lamnidae . . . (99)	Isurinae	<i>Isurus</i> Gill.
				<i>Carcharodon</i> A. Smith.
		Odontaspididæ (100)		<i>Eugomphodus</i> Gill.
		Alopiidæ . . . (101)		<i>Alopias</i> Raf.
	<i>Galeorhinoidea</i>	Sphyrnidæ . . (102)		<i>Sphyrna</i> Raf.
				<i>Reniceps</i> Gill.
		Galeorhinidæ (103)	Galeorhininae	<i>Enlania</i> Gill.
				<i>Aprionodon</i> Gill.
				<i>Scoliodon</i> Müll. & Henle.
				<i>Galeocerdo</i> Müll. & Henle.
	<i>Scyrnioidea</i>		Mustelinæ	<i>Mustelus</i> Cur.
		Spinacidæ . . . (104)		<i>Squalus</i> (Arted.) Raf.
				<i>Centroscyllium</i> Müll. & Henle.
		Seymniidæ . . . (105)		<i>Somniosus</i> Les.

CLASS C.—MARSIPOBRANCHII.

ORDER 11.—HYPEROARTIA.

Sub-order.	Super family.	Family.	Sub-family.	Genus.
		Petromyzontidæ..(106)	Petromyzontinæ.	Petromyzon (Linn.) Gray. Ammocetes (Dum.) Gill.

ORDER 12.—HYPEROTRETA.

		Myxinidæ.....(107)	Myxine Linn.
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CLASS D.—LEPTOCARDII.

ORDER 13.—CIRROSTOMI.

		Branchiostomidæ.(108)	Branchiostoma Cest.
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2.—LIST OF SPECIES.

1.—MALTHEIDÆ.

- MALTHE VESPERTILIO** (Linn.) Cuv.—Bat-fish; nose-fish.
Newfoundland to Florida.
- MALTHE CUBIFRONS** Rich.—Box-headed sea-bat.
Labrador.
- MALTHE NOTATA** (Val.) Lütken.—Spotted sea-bat.
Southern Atlantic coast.

2.—LOPHIIDÆ.

- LOPHIUS AMERICANUS** DeKay.—Bellows-fish (*Newport, R. I.*); goose-fish (*Massachusetts*); monk-fish (*coast of Maine*); also fishing-frog, American angler, sea-devil, &c.
Nova Scotia to Cape Hatteras.

3.—CERATIIDÆ.

- HIMANTOLOPHUS GROENLANDICUS** Reinhardt.—Tufted frog-fish.
Greenland.
- ONEIRODES ESCHRICHTII** Lütken.—Eschricht's frog-fish.
Greenland.
- CERATIAS HOLBOLLI** Kroyer.—Holboll's frog-fish.
Greenland.

4.—ANTENNARIIDÆ.

- PTEROPHYRNE LÆVIGATA** (Cuv.) Gill.—Common frog-fish; mouse-fish; pescador (*Cuba*); toad-fish; devil-fish (*Bermuda*).
Pelagic; accidental on coast.

5.—ORTHAGORISCIDÆ.

- MOLACANTHUS NUMMULARIS** (Walb.) Gill.—Globe-fish.
Pelagic; accidental on coast.
- MOLA ROTUNDA** Cuv.—Sun-fish; pez mola (*Cuba*).
Newfoundland to Cape Hatteras.

* In giving the occurrence of any species of fish, as from Cape Cod to Cape Hatteras, or between other limits, it is not necessarily to be understood that specimens have actually been taken at these extremes, but only at some point between them. They may, however, be looked for at other localities within the same range.

6.—DIODONTIDÆ.

CHILOMYCTERUS GEOMETRICUS (Linn.) Kaup.—Spiny box-fish; rabbit-fish (*Vineyard Sound*); erizo (*Cuba*).

Cape Cod to Florida.

TRICHODIODON PILOSUS (Mitch.) Bleeker.—Hairy box-fish.

Cape Cod to Cape Hatteras.

7.—TETRODONTIDÆ.

TETRODON LEVIGATUS (Linn.) Gill.—Smooth puffer; tambor (*Cuba*).

Cape Cod to Florida.

CHILICHTHYS TURGIDUS (Mitch.) Gill.—Rough puffer; porcupine-fish; blower; swell-fish; tambor (*Cuba*).

Cape Cod to Florida.

8.—OSTRACIONTIDÆ.

LACTOPHYRYS TRIGONUS (Linn.) Poey.—Trunk-fish; box-fish.

West Indian; accidental on the coast (found once at Holmes's Hole, Mass).

9.—BALISTIDÆ.

ALUTERA CUSPICAUDA DeKay. (d. s.)—Long-tailed file-fish.

Cape Cod to Florida.

CERATACANTHUS AURANTIACUS (Mitch.) Gill.—hog-fish; file-fish.

Cape Cod to Florida.

STEPHANOLEPIS SETIFER (Bennett) Gill.—Storer's file-fish; fool-fish (*New York*).

Nova Scotia to Florida.

BALISTES CAPRISCUS Linn.—European file-fish; Turbot (*Berm*).

Nova Scotia to Florida.

BALISTES POWELLI Cope. (d. s.)—Powel's file-fish.

Rhode Island. (Accidental.)

10.—HIPPOCAMPIDÆ.

HIPPOCAMPUS HUDSONIUS DeKay.—Sea-horse; horse-fish.

Cape Cod to Cape Hatteras.

11.—SYNGNATHIDÆ.

SYNGNATHUS PECKIANUS Storer.—Pipe-fish.

Newfoundland to Cape Hatteras.

12.—CENTRISCIDÆ.

CENTRISCUS SCOLOPAX Linn.—Snipe-fish.

European; accidental in American waters (found once in Massachusetts).

13.—FISTULARIIDÆ.

FISTULARIA TABACCARIA Linn.—Tobacco trumpet-fish; unarmed trumpet-fish.

Cape Cod to Florida. (Occasional; specimens obtained at New York.)

14.—GASTEROSTEIDÆ.

APELTES QUADRACUS (Mitch.) Brev.—Four-spined stickle-back.
New Brunswick to Florida.

GASTEROSTEUS ACULEATUS Linn.—Common stickle-back.
Greenland to Newfoundland (at least).

GASTEROSTEUS BIACULEATUS Shaw. (d. s.)—Two-spined stickle-back.
Newfoundland and Labrador.

GASTEROSTEUS NIGER Cuv. and Val. (d. s.)—Black stickle-back.
Newfoundland.

GASTEROSTEUS NOVEBORACENSIS Cuv. and Val. (d. s.)—New York, stickle-back.

New Brunswick to Cape Hatteras.

PYGOSTEUS OCCIDENTALIS (Cuv. and Val.) Brevoort.—Ten-spined stickle-back.

Newfoundland to Cape Hatteras.

15.—SOLEIDÆ.

PLAGUSIA PLAGIUSA (Linn.) Gill. (d. @ s.)—Long sole.
Cape Hatteras to Florida.

ACHIRUS LINEATUS (Linn.) Cuv.—American sole; calico; hog-choker
(*New Jersey*); coverclip (*New Jersey*); spotted sole (*Massachusetts Bay*).
Cape Cod to Florida.

16.—PLEURONECTIDÆ.

EUCHALARODUS PUTNAMI Gill.—Putnam's flat-fish.

Nova Scotia to Cape Cod. (Found only in Salem Harbor, Mass.)

PSEUDOPLEURONECTES AMERICANUS (Walb.) Gill.—Common flounder,
winter-flounder; mud dab (*Massachusetts Bay*); sole (*New York*).

Nova Scotia to Cape Hatteras.

MYZOPSETTA FERRUGINEA (Storer) Gill.—Rusty dab; sand dab (*Maine*).
Nova Scotia to Cape Cod.

LIMANDA ROSTRATA (H. R. Storer) Gill.—American dab.
Labrador.

PLEURONECTES GLABER (Storer) Gill.—Smooth plaice; smooth back.
Massachusetts to Maine.

GLYPTOCEPHALUS ACADIANUS Gill.—Long dab.
Maine.

- LOPHOPSETTA MACULATA (Mitch.) Gill.—Spotted turbot; window-pane (*New Jersey*); sand flounder (*New York*).
Cape Cod to Cape Hatteras.
- CITHARICHTHYS MICROSTOMUS Gill.—Whiff.
New Jersey to Cape Hatteras.
- HIPPOGLOSSOIDES PLATESSOIDES (Fabr.) Gill.—Arctic dab.
Polar regions (Greenland).
- POMATOPSETTA DENTATA (Storer) Gill.—Summer flounder.
Nova Scotia to Cape Hatteras.
- CHÆNOPSETTA OCELLARIS (De Kay) Gill.—Common flounder.
Cape Cod to Cape Hatteras.
- CHÆNOPSETTA DENTATA (Linn.) Gill.—Southern flounder.
Cape Hatteras to Florida.
- CHÆNOPSETTA OBLONGA (Mitch.) Gill.—Four-spotted flounder.
Cape Cod to Cape Hatteras.
- HIPPOGLOSSUS AMERICANUS Gill (d. s.)—Halibut.
Newfoundland to Cape Hatteras.
- REINHARDTIUS HIPPOGLOSSOIDES (Walb.) Gill.—Greenland halibut.
Greenland.

17.—MACRURIDÆ.

- MACRURUS RUPESTRIS Bloch.—Ingmingoak (*Greenland*).
Greenland.
- CORYPILENOIDES NORVEGICUS (Gunner) Günth.
Greenland.

18.—GADIDÆ.

- BOREOGADUS POLARIS (Sabine) Gill.—Misarkornak (*Greenland*).
Polar regions.
- POLLACHIUS CARBONARIUS (Linn.) Bon.—Pollock; coal-fish (*England*).
Greenland to Cape Hatteras.
- GADUS MORRHUA Linn.—Common cod-fish; sarandlik and sarand-lisksoak (*Greenland*).
Polar regions to Cape Hatteras.
- GADUS OJAC Rich. (d. s.)—Greenland cod-fish; ojac or ovak (*Greenland*).
Polar regions.
- MICROGADUS TOMCODUS (Walb.) Gill.—Tom-cod; frost-fish.
Newfoundland to Cape Hatteras.
- MELANOGRAMMUS ÆGLEFINUS (Linn.) Gill.—Haddock.
Newfoundland to Cape Hatteras.
- PHYCIS CHUSS (Walb.) Gill.—Codling (*New York*); old English hake; squirrel hake (*Mass.*); ling; chuss (*formerly at New York*); codling (*Newport*); fork-beard (*England*).
Newfoundland to Cape Hatteras.
- PHYCIS TENUIS (Mitch.) DeKay.—Codling (*New York*); white hake (*Mass.*); squirrel hake (*Maine*).
Newfoundland to Cape Hatteras.

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- UROPHYCIS REGIUS** (Walb.) Gill.—Spotted codling.
Cape Cod to Cape Hatteras.
- MOLVA VUGARIS** Flem.—Ling (*Great Britain*); iverksoak (*Greenland*).
Polar regions.
- ONOS REINHARDTII** (Kroyer) Gill.—Five-bearded rockling.
Greenland.
- ONOS ENSIS** (Reinhardt) Gill.—Three-bearded rockling.
Greenland.
- RHINONEMUS CAUDACUTA** (Storer) Gill. (d. s.)—4-bearded rockling.
Nova Scotia to Cape Cod.
- CILIATA ARGENTATA** (Reinh.) Gill.—Mackerel-midge.
Greenland to Cape Hatteras
- BROSMIUS BROSMÆ** (Fabr.) White. (d. @ s.)—European cusk; nejor-pallujak (*Greenland*); torsk or tusk (*Great Britain*).
Polar regions to Cape Cod.
- BROSMIUS AMERICANUS** Gill. (d. s.)—Cusk (*Mass.*); torsk or tusk (*British provinces*).
Nova Scotia to Cape Cod.
- BROSMIUS FLAVESCENS** Lesueur. (d. s.)—Cusk.
Banks of Newfoundland.

19.—MERLUCIIDÆ.

- MERLUCIUS VULGARIS** Flem. (d. @ s.)—European hake; akullia-kitsok (*Greenland*).
Greenland.
- MERLUCIUS BILINEARIS** (Mitch.) Gill.—American hake; silver hake (*Maine*); whiting (*Mass*); stock-fish.
Nova Scotia to Cape Hatteras.

20.—OPHIDIIDÆ.

- OPHIDIUM MARGINATUM** Mitch.—Little cusk (*New York*).
Cape Cod to Cape Hatteras.

21.—BROTULIDÆ.

- BYTHITES FUSCUS** Reinhardt.—Amersulak (*Greenland*).
Greenland.

22.—LYCODIDÆ.

- GYMNELIS VIRIDIS** Reinhardt.—Unernak (*Greenland*).
Polar regions.
- LYCODES VAHLII** Reinhardt.—Vahl's lycodes; misarkornak (*Greenland*).
Greenland.

LYCODES RETICULATUS Reinhardt.—Reticulated lycodes; *akulha-kitsok* (*Greenland*).

Greenland.

LYCODES PERSPICILLUM Kroyer.—Spotted lycodes.

Greenland.

LYCODES SEMINUDUS Reinhardt.—Half-naked lycodes.

Greenland.

LYCODES NEBULOSUS Kroyer.—Cloudy lycodes.

Greenland.

LYCODES MUCOSUS Richardson.—Slimy lycodes.

Greenland.

LYCODES POLARIS (Sabine) Rich.—Arctic lycodes.

Polar regions.

ZOARCES ANGUILLARIS (Peck) Storer.—Eel-pout; conger-eel (*Massachusetts Bay*); lamper-eel (*Eastport*).

Newfoundland to Cape Hatteras.

23.—CRYPTACANTHIDÆ.

CRYPTACANTHODES MACULATUS Storer.—Ghost-fish; wry-mouth.

Nova Scotia to Cape Cod.

CRYPTACANTHODES INORNATUS Gill.—Ghost-fish; conger-eel (*Me.*)

Nova Scotia to Cape Cod.

24.—STICHÆIDÆ.

EUMESOGRAMMUS SUBBIFURCATUS (Storer) Gill; Little eusk (*Me.*)

Nova Scotia to Cape Cod.

EUMESOGRAMMUS PRÆCISUS (Kroyer) Gill.

Greenland.

STICHLÆUS PUNCTATUS (Fabr.) Reinh.

Greenland.

LEPTOCLINUS ACULEATUS (Reinh.) Gill.

Greenland.

ANISARCHUS MEDIUS (Reinh.) Gill.

Greenland.

LUMPENUS FABRICII Reinhardt.

Greenland.

LEPTOBLENNIUS SERPENTINUS (Storer) Gill.

Nova Scotia to Cape Cod.

LEPTOBLENNIUS GRACILIS (Stuvitz) Gill.

Greenland.

CENTROBLENNIUS NUBILUS (Rich.) Gill.

Greenland.

25.—XIPHIDIONTIDÆ.

MURÆNOIDES FASCIATUS (Schneider) Gill.—Banded butter-fish.

Greenland.

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MURÆNOIDES MUCRONATUS (Mitch.) Gill. (d. s.)—Common butter-fish.
Nova Scotia to Cape Hatteras.

Varieties. (†)

MURÆNOIDES MACROCEPHALUS (Girard) Gill. (d. s.)
Massachusetts.

MURÆNOIDES INGENS (H. R. Storer) Gill. (d. s.)
Labrador.

ASTERNOPTERYX GUNELLIFORMIS Rüppell. (d. @ g.)
Greenland. (†)

26.—ANARRHICHADIDÆ.

• **ANARRHICHAS VOMERINUS** (Ag.) Storer. (d. s.)—Wolf-fish; cat-fish
(*New England*) ; kigutilik (*Greenland*).
Greenland to Cape Hatteras.

ANARRHICHAS STEENSTRUPII Gill. (d. s.)—Steenstrup's wolf-fish;
kærrak (*Greenland*).
Greenland.

ANARRHICHAS DENTICULATUS Kroyer.—Small-toothed wolf-fish.
Greenland.

27.—BLENNIIDÆ.

BLENNIUS FUCORUM Cuv. and Val. (d. @ s.; d. @ g.)—Sea-weed blenny.
South Carolina.

BLENNIUS GEMINATUS Wood. (d. @ g.)—Blenny.
South Carolina.

HYPLEUROCHILUS PUNCTATUS (Wood) Gill.—Spotted blenny.
Cape Hatteras to Florida.

PHOLIS CAROLINUS Val.—Carolina blenny.
Cape Hatteras to Florida.

HYPSOBLENNIUS HENTZII (Les.) Gill.—Hentz's blenny.
South Carolina.

CHASMODES BOSCIANUS (Lac.) Cuv. and Val.—Bosc's shanny.
New York to Florida.

CHASMODES QUADRIFASCIATUS Val.—Four-banded shanny.
South Carolina.

CHASMODES NOVEMLINEATUS Val.—Nine-lined shanny.
South Carolina.

28.—BATRACHIDÆ.

BATRACHUS TAU Linn.—Toad-fish; oyster-fish (*New Jersey and Florida*);
sapo (*Cuba*).
Nova Scotia to Florida.

29.—URANOSCOPIDÆ.

ASTROSCOPUS ANOPLUS (Cuv. and Val.) Brevoort.—Naked star-gazer.
New York to Florida.

30.—CYCLOPTERIDÆ.

CYCLOPTERUS LUMPUS Linn.—Common lump-fish; lump-sucker, sea-owl, paddle (*Great Britain*); Licorne de mer (*France*).

Polar regions to Cape Hatteras.

EUMICROTREMUS SPINOSUS (Fabr.) Gill.—Spinous lump-fish.

Greenland to Bay of Fundy.

31.—LIPARIDIDÆ.

LIPARIS LINEATA (Lepechin) Kroyer.—Lineated liparis, or sea snail.

Polar regions to Cape Cod.

LIPARIS ARCTICA Gill.—Arctic liparis.

Greenland (Port Foulke).

LIPARIS FABRICII Kroyer.—Fabricius' liparis.

Greenland.

LIPARIS MONTAGUI Don.—Montagu's liparis, or sea-snail.

Polar regions to Cape Cod.

ACTINOCHIR MAJOR (Walb.) Gill.—Large liparis.

Greenland.

CAREPROCTUS REINHARDTII Kroyer.—Reinhardt's liparis.

Greenland.

32.—GOBIIDÆ.

GOBIOSOMA ALEPIDOTA (Lac.) Girard.—Scaleless goby.

Cape Cod to Florida.

GOBIUS CAROLINENSIS Gill.—Black goby.

Cape Hatteras to Florida.

DORMITATOR LINEATUS Gill.—Striped sleeper.

Cape Hatteras to Florida.

33.—TRIGLIDÆ.

DACTYLOPTERUS VOLITANS (Linn.) Lac.—Flying-robin; murcielago (*Cuba*); civetta de mare (*Naples*); bat-fish (*Bermudas*).

Newfoundland to Florida.

PRIONOTUS EVOLANS (Linn.) Gill.—Lined Sea-robin; flying-fish (*New Jersey*).

Cape Cod to Florida.

PRIONOTUS PUNCTATUS (Bloch.) Cuv.—Spotted sea-robin; rubio volador (*Cuba*).

Florida.

PRIONOTUS CAROLINUS (Linn.) Cuv. and Val.—Web-fingered sea-robin; Carolina robin.

Cape Cod to Florida.

PRIONOTUS PILATUS Storer. (d. s.)—Small-scaled sea-robin.

Massachusetts.

TRIGLA CUCULUS Linn. (d. & s.)—European gurnard.

European; accidental at New York.

34.—AGONIDÆ.

ASPIDOPHOROIDES MONOPTERYGIUS (Bloch) Storer.

Polar regions to Cape Cod.

AGONUS CATAPHRACTUS (Linn.) Bl. Schn.—Sea-poacher.

Polar regions (Greenland.)

ARCHAGONUS DECAGONUS (Bl. Schn.) Gill.

Greenland.

35.—COTTIDÆ.

COTTUS OCTODECIMSPINOSUS Mitchill.—Slender sculpin; grubby.

Nova Scotia to Cape Hatteras.

COTTUS ÆNEUS Mitchell (d. s.)—Little sculpin.

Cape Cod to Cape Hatteras.

COTTUS GRÆNLANDICUS Cuv. and Val. (d. s.)—Northern sculpin.

Polar regions to Cape Hatteras.

Varieties. (?)

COTTUS POROSUS Cuv. and Val. (d. s.)

Baffin's Bay.

COTTUS OCELLATUS H. R. Storer. (d. s.)

Greenland to Newfoundland.

COTTUS LABRADORICUS H. R. Storer. (d. s.)

Greenland to Newfoundland.

COTTUS GLACIALIS Richardson. (d. s.)

Greenland.

COTTUS PACHYPUS Günther. • (d. s.)

Polar regions (Greenland).

COTTUS MITCHILLI Cuv. and Val. (d. s.)

Newfoundland to Cape Hatteras.

COTTUS SCORPIOIDES Fabricius. (d. @ g.)

Greenland.

GYMNACANTHIUS TRICUSPIS (Reinhardt) Gill. (d. s.)

Polar regions.

GYMNACANTHIUS PATRIS (H. R. Storer) Gill. (d. s.)

Labrador to Bay of Fundy.

ONCOCOTTUS QUADRICORNIS (Linn.) Gill.

Polar regions.

ICELUS BICORNIS Reinhardt. (d. @ g.)

Greenland.

ICELUS UNCINATUS Reinhardt. (d. @ g.)

Greenland.

COTTUS POLARIS Sabine. (d. @ g.)

Polar regions.

TRIGLOPS PINGELII Reinhardt.

Greenland.

TRIGLOPS PLEUROSTICTUS Cope.

Greenland.

36.—HEMITRIPTERIDÆ.

HEMITRIPTERUS ACADIANUS (Walbaum) Storer.—Sea-raven; yellow sculpin.

Newfoundland to Cape Hatteras.

37.—SCORPÆNIDÆ.

SCORPÆNA PORCUS Linn. (d. @ s.)—Pig-foot.

European; (accidental at New York.)

SCORPÆNA PLUMIERI Bl. Schn. (d. @ s.) Plumer's pig-foot.

West Indian; occasional on northern coast.

SEBASTES NORVEGICUS (Linn.) Cuv. (d. @ s.)—Norway haddock; hemdurgan.

Polar regions to Cape Cod.

SEBASTES VIVIPARUS Kroyer (d. s.)—Red-fish; bream (*Maine*); rose-fish; snapper (*Massachusetts Bay*, Storer); red sea-perch (*New York*); red perch (*Eastport*).

Polar regions to Cape Cod.

SEBASTES FASCIATUS Storer. (d. s. and d. @ g.) Banded red-fish.

Accidental to Massachusetts. (?)

38.—LABRIDÆ.

TAUTOGA ONITIS (Linn.) Gthr.—Black-fish; tautog.

Bay of Fundy to South Carolina; New York.

TAUTOGOLABRUS ADSPERSUS (Walbaum) Gill.—Burgall or bergall (*New York*); cunner or conner; chogset (*N. E.*); blue-fish or blue perch.

Newfoundland to Cape Hatteras.

XYRICHTHYS LINEATUS (Gmel.) Cuv. and Val.—Razor-fish.

West Indian, (occasional on Southern coast?)

CHÆROJULIS GRANDISQUAMIS Gill.

North Carolina.

38a.—POMACENTRIDÆ.

GLYPHIDODON SAXATILIS (Linn.) Cuv. and Val.—Cow-pilot (*Berm.*).

West Indian (accidental on northern coast; found at Newport.)

39.—POLYNEMIDÆ.

TRICHIDION PLUMIERI (Lac.) Gill.—Thread-fish.

West Indies; occasional northward. (?)

TRICHIDION OCTOPILIS Gill.—Eight-threaded thread-fish.

New York (accidental).

40.—TEUTHIDIDÆ.

ACANTHURUS CHIRURGUS Bloch. and Schneider.—Surgeon-fish; barbero (*Cuba*); doctor-fish (*Bermudas*).

West Indies; occasional northward.

ACANTHURUS NIGRICANS Linn.—Black surgeon

West Indies; occasional northward.

41.—CHAETODONTIDÆ.

SAROTHRODUS MACULOCINCTUS Gill.

Cape Cod to Cape Hatteras.

HOLACANTHUS CILIARIS Lac.—Isabelita (*Cuba*); angel-fish (*Berm.*)

West Indies; occasional northwards.

42.—XIPHIIDÆ.

XIPHIAS GLADIUS Linn.—Common sword fish.

Nova Scotia to West Indies.

TETRAPTURUS ALBIDUS Poey.—The Bill-fish; The Spear-fish.

Cape Cod to West Indies.

HISTOPHORUS GLADIUS (Brouss.) Gthr.—The Sail-fish.

Cape Cod to West Indies.

43.—TRICHIURIDÆ.

TRICHIURUS LEPTURUS Linn.—Silvery hair-tail.

Cape Cod to Florida.

44.—SCOMBRIDÆ.

SCOMBER SCOMBRUS Linn. (d. & s.)—Mackerel; wawwhunnekesuog (*Narragansett Indians*, Trumbull); caballa (*Cuba*).

Greenland to Cape Hatteras.

SCOMBER COLIAS Linnæus. (d. & s.)—Chub-mackerel.

Nova Scotia to Cape Hatteras.

SARDA PELAMYS (Linn.) Cuv.—Bonito; skip-jack (*Boston market*).

Cape Cod to Florida.

ORCYNUS SECUNDI-DORSALIS (Storer) Gill. (d. s.)—Horse-mackerel (*Massachusetts*, &c.); albicore (*Rhode Island*); American tunny.

Newfoundland to Florida.

ORCYNUS ALLITERATUS (Raf.) Gill.—Little tunny; albicore; alleterato (*Naples*); mackerel (*Berm.*); pelagic, occasional on coast (found in large numbers at *Wood's Hole, Massachusetts, August, 1871*).

CYBIUM MACULATUM (Mitch.) Cuv.—Spanish mackerel; spotted mackerel; bay mackerel. (rare in *Massachusetts Bay*.)

Cape Cod to Florida.

CYBIUM REGALE (Bloch) Cuv.—Cero; black-spotted Spanish mackerel; king fish.

Cape Cod to Florida.

45.—CARANGIDÆ.

VOMER SETIPINNIS (Mitch.) Ayres.—Horse-fish; jorobado (*Cuba*).

Maine to Florida.

SELENE ARGENTEA Lac.—Silver moon-fish; jorobado (*Cuba*).

Cape Cod to Florida.

ARGYRIOSUS VOMER Lac.—Jorobado (*Cuba*).

Cape Cod to Florida.

- ARGYRIOSUS CAPILLARIS** (Mitch.) DeKay. (d. s.)
Cape Cod to Florida.
- DECAPTERUS PUNCTATUS** (Mitch.) Gill.—Dotted scad; round robin (*Bermudas*).
Cape Cod to Florida.
- DECAPTERUS MACARELLUS** (Cuv. and Val.) Gill.—Mackerel scad.
Cape Cod to Florida. (*Wood's Hole, Massachusetts, 1873*).
- TRACHUROPS CRUMENOPHTHALMUS** (Bloch) Gill.—Big-eyed scad; chicharro (*Cuba*); goggler; goggle-eyed Jack (*Bermudas*).
Cape Cod to Florida.
- PARATRACTUS PISQUETOS** (Cuv. et Val.) Gill.—Yellow crevallé; cojinna (*Cuba*). Jack, Buffalo Jack (*Bermuda*).
Cape Cod to Florida.
- CARANGUS HIPPOS** (Linn.) Gill.—Horse-crevallé; jiguagua (*Cuba*).
Cape Cod to Florida.
- CARANGUS FALLAX** (Cuv. et Val.) Girard.—Jurel (*Cuba*).
South Carolina.
- CARANGUS CHRYSOS** (Mitch.) Gill.—Yellow-mackerel (*New York*).
Cape Cod to Florida.
- CARANGOPS FALCATUS** (Holbr.) Gill.
South Carolina.
- BLEPHARICHTHYS CRINITUS** (Akerly) Gill.—Thread-fish.
Cape Cod to Florida.
- CHLOROSCOMBRUS CHRYSURUS** (Linn.) Gill.—Casabe (*Cuba*).
Cape Cod to Florida.
- TRACHYNOTUS OVATUS** (Linn.) Gthr.—Short pompano; palorrieta (*Cuba*).
Cape Cod to Florida.
- TRACHYNOTUS GLAUCUS** Cuv. and Val.—Glaucous pompano.
South Carolina to Florida.
- TRACHYNOTUS CAROLINUS** (Linn.) Gill.—Pompano (*Southern Coast*); cavallé or crevallé (*South Carolina*); pompynose (*New Orleans*).
Cape Cod to Florida.
- NAUCRATES DUCTOR** (Linn.) Raf.—Pilot-fish; pilot, romero (*Cuba*).
Pelagic; occasional on coast.
- ZONICHTHYS FASCIATUS** (Bloch) Sw.
South Carolina.
- HALATRACTUS ZONATUS** (Mitch.) Gill.—Rudder-fish; bonito (*Berm.*)
Cape Cod to Florida.
- HALATRACTUS CAROLINENSIS** (Holbr.) Gill.
South Carolina.

46.—CORYPHAENIDÆ.

- CORYPHÆNA SUEURI** Cuv. and Val.—Lesneur's dolphin.
Pelagic; occasional on coast.
- CORYPHÆNA PUNCTULATA** (Cuv. and Val.) Gthr.—Small-spotted dolphin.
Pelagic; occasional on coast

47.—STROMATEIDÆ.

PALINURICHTHYS PERCIFORMIS (Mitch.) Gill.—Black rudder-fish.

Maine to Cape Hatteras.

PORONOTUS TRIACANTHUS (Peck) Gill.—Harvest-fish (*New Jersey*);
butter fish (*Massachusetts*); dollar fish (*Maine*).

Maine to Cape Hatteras.

PEPRILUS GARDENII (Bl. Schn.) Gill.

New York to Florida.

48.—BRAMIDÆ.

PTERACLIS CAROLINUS Val.

South Carolina.

49.—LAMPRIDIDÆ.

LAMPRIS GUTTATA Retz.—Opah.

Occasional off Newfoundland.

50.—ZENIDÆ.

ZENOPSIS OCELLATUS (Storer) Gill. (d. s.)—Ocellated dory.

Massachusetts. (Accidental? Identical with *Z. conchifer*?)

51.—MULLIDÆ.

MULLUS, sp. incog.

West Indian (?); occasional on coast (found at New York).

52.—BERYCIDÆ.

HOLOCENTRUM SOGHIO Bloch—Matajuelo (*Cuba*); squirrel (*Berm.*)

West Indian; accidental on northern coast (found at Newport,
Rhode Island).

53.—SCIÆNIDÆ.

CYNOSCION CAROLINENSIS (Cuv. and Val.) Gill.—Salmon-trout; spotted
sea-trout (*south coast*); spotted silver-sides (*Scott*).

Cape Hatteras to Florida.

CYNOSCION REGALIS (Bloch) Gill.—Squeteague or squit (*New England*);
shecutts or checutts (*Mohegan Indians*); chickwick (*Connecticut*);
weak-fish (*New York*); blue-fish (*Beesley's Point, New Jersey*); trout
(*southern coast*); salt-water trout; gray trout (*southern coast*).

Cape Cod to Florida.

CYNOSCION THALASSINUS (Holbr.) Gill.

Cape Hatteras to Florida.

CYNOSCION NOTHUS (Holbr.) Gill.

Cape Hatteras to Florida.

POGONIAS CHROMIS Lacep.—Drum.

Cape Cod to Florida.

- LIOSTOMUS XANTHURUS** Lacep.—Yellow-tail.
Cape Cod to Florida.
- LIOSTOMUS OBLIQUUS** (Mitch.) DeKay.—Lafayette (*New York*); goody (*Cape May*); chub (*Norfolk*); roach (*Northampton County, Virginia*).
Cape Cod to Florida.
- STELLIFERUS LANCEOLATUS** (Holbr.) Gill.
Cape Hatteras to Florida.
- BAIRDIELLA PUNCTATA** (Linn.) Gill.—Silver-perch (*New Jersey*).
Cape Cod to Florida.
- SCIÆNOPS OCELLATUS** (Linn.) Gill.—Bass; red bass; sea-bass; spotted bass (*South Carolina*); red-fish (*Gulf of Mexico*).
Cape Cod to Florida.
- MENTICIREUS ALBURNUS** (Linn.) Gill.—Carolina whiting.
Cape Hatteras to Florida.
- MENTICIREUS NEBULOSUS** (Mitch.) Gill.—King-fish; whiting; lake (*New Jersey*); barb (*New Jersey*).
Cape Cod to Florida.
- MENTICIREUS LITTORALIS** (Holbr.) Gill.—Shore-whiting.
Cape Hatteras to Florida.
- MICROPOGON UNDULATUS** (Linn.) Cuv. and Val.—Croaker; verrugato (*Cuba*).
Cape Cod to Florida.
- LABIMUS FASCIATUS** Holbrook.
Cape Hatteras to Florida.

54.—GERRIDÆ.

- EUCLINOSTOMUS ARGENTEUS** Baird and Girard. (d. s., d. @ g.)
New Jersey southwards.

55.—PIMELEPTERIDÆ.

- PIMELEPTERUS BOSCH** Lac.—Chopa-banca (*Cuba*); bream (*Berm.*)
Cape Cod to Florida.

56.—SPARIDÆ.

- LAGODON RHOMBOIDES** (Linn.) Holbrook.—Sargo (*Cuba*).
Cape Cod to Florida.
- ARCHOSARGUS PROBATOCEPHALUS** (Walb.) Gill.—Sheep's-head.
Cape Cod to Florida.
- STENOTOMUS ARGYROPS** (Linn.) Gill.—Scup (*Vineyard Sound*); scup-paug; porgy (*New York*); bream (*Rhode Island, formerly*); fair-maid (*East Shore of Virginia*).
Cape Cod to Florida.
- SPARUS ACULEATUS** (Cuv. and Val.) Gill. (d. s., d. @ g.)—Gilt-head.
Cape Hatteras to Florida.

57.—PRISTIPOMATIDÆ.

- HÆMULON ARCUATUM** Cuv. and Val.—Grunts.
 South Atlantic coast of United States.
HÆMULON FORMOSUM (Linn.) Cuv.
 South Atlantic coast of United States.
HÆMULON CHRYSOPTERON (Linn.) Cuv.
 South Atlantic coast of United States.
HÆMULON QUADRILINEATUM (Cuv. and Val.)—Striped grunt (*Berm.*)
 South Atlantic coast of United States.
ORTHOPRISTIS FULVOMACULATUS (Mitch.) Gill.
 South Atlantic coast of United States.
ANISOTREMUS VIRGINICUS (Linn.) Gill.
 South Atlantic coast of United States.
LUTJANUS CAXIS (Bl. Schn.) Gill.—Yelting, glass-eyed snapper (*Berm.*)
 South Atlantic coast of United States.

58.—SERRANIDÆ Gill.

- PROMICROPTERUS MACULATUS** (Holbr.) Gill.—Soap fish.
 Cape Hatteras to Florida.
PROMICROPTERUS DECORATUS Gill. (d. @ s.)
 Newport, R. I. (Accidental.)
HYPORTHODUS FLAVICAUDA Gill.
 Newport, R. I. (Accidental.)
EPINEPHELUS MORIO (Cuv.) Gill.—Red grouper (*New York ?*);
 cherna de vovero (*Cuba*).
 Cape Cod to Florida.
EPINEPHELUS NIGRITUS (Holbr.) Gill. (d. @ g.)
 Cape Hatteras to Florida.
EPINEPHELUS OXYPTERUS (DeKay) Gill. (d. s.; d. @ g.)
 New York. (Accidental). (?)
TRISOTROPIS ACUTIROSTRIS (Cuv. and Val.) Gill.
 Cape Hatteras to Florida.
PROMICROPS GUASA (Poey) Gill.—Guasa, (*Cuba*).
 Florida.
CENTROPRISTIS ATRARIUS (Linn.) Barn.—Black sea-bass; sea-bass
 (*New York*); black-perch (*Mass.*); black-bass; black-fish (*New Jersey*);
 blue-fish (*Newport*); black-harry; hannabills (*New York, DeKay*);
 black-will (*Eastern Shore of Virginia*).
 Cape Cod to Florida.
TRILOBURUS TRIFURCUS (Linn.) Gill.
 Cape Hatteras to Florida.
DIPLECTRUM FASCICULARE (Cuv. and Val.) Holbrook—Serrano (*Cuba*).
 Cape Hatteras to Florida.
DULES AURIGA Cuv. and Val.—Charioteer; coachman (*DeKay*).
 Cape Cod to Florida.

59.—LABRACIDÆ.

ROCCUS LINEATUS (Bl. Schn.) Gill.—Striped bass (*Eastern States*); rock-fish (*Pennsylvania*, etc.); missuckeke-kequoock (*Narragansett Indians*).
Nova Scotia to Florida.

MORONE AMERICANA (Gmelin) Gill.—White perch.
Nova Scotia to Florida.

60.—EPHIPPIIDÆ.

PAREPHIPPUS QUADRATUS (Gun.) Gill.—Moon-fish.
Cape Cod to Florida.

PAREPHIPPUS FABER (Cuv.) Gill.—Moon-fish; angel-fish (*South Carolina*); 3-banded sheep-head; 3 tailed porgy.
Cape Cod to Florida.

61.—LOBOTIDÆ.

LOBOTES SURINAMENSIS Cuv.—Flasher (*New York market*).
Cape Cod to Florida.

62.—POMATOMIDÆ.

POMATOMUS SALTATRIX (Linn.) Gill.—Blue-fish (*New York, and New England except Rhode Island*); horse-mackerel (*Newport, and Beesley's Point, N. J.*); skip-jack (*North Carolina*); green-fish (*Virginia, DeKay*); tailor (*Maryland and Virginia*); white-fish and snap-mackerel (young).

63.—ELACATIDÆ.

ELACATE CANADUS (Linn.) Gill.—Crab-eater.
Cape Cod to West Indies.

64.—CHILODIPTERIDÆ.

APOGONICHTHYS AMERICANUS Castelnau.
West Indian; occasional northwards (found at Newport, R. I.)

65.—PRIACANTHIDÆ.

PRIACANTHUS MACROPHthalmus Cuv. (d. s.)—Common big-eye.
West Indian; occasional northwards.

PSEUDOPRIACANTHUS ALTUS (Gill.) Bleeker.—Short big-eye.
Cape Cod to Cape Hatteras.

66.—AMMODYTIDÆ.

AMMODYTES AMERICANUS DeKay.—Sand-launce; sand-eel (*N. Eng.*)
Newfoundland to Cape Hatteras.

AMMODYTES DUBIUS Reinhardt.
Polar regions to Cape Cod.

ARGYROTÆNIA VITTATA (DeKay) Gill. (d. s.; d. @ g.)
New York. (†)

67.—ECHINEIDIDÆ.

LEPTECHENEIS NAUCRATES (Linn.) Gill.—Sucker-fish.

Coast generally.

LEPTECHENEIS NAUCRATEOIDES (Zuiew) Gill. (d. s.)

Coast generally.

RHOMBOCHIRUS OSTEOCHIR (Cuv.) Gill.

West Indian ; occasional on northern coast (found at New Bedford, Massachusetts.)

REMOROPSIS BRACHYPTERA (Lowe) Gill.

Occasional on northern coast (found at Holme's Hole, Massachusetts.)

ECHENEIS REMORA Linn.—Sucker ; pega (*Cuba*).

Coast generally.

68.—SPHYRÆNIDÆ.

SPHYRÆNA BORREALIS DeKay.—Northern barracuda ; sennet (*Berm.*)

Cape Cod to Florida.

69.—MUGILIDÆ.

MUGIL ALBULA Linn.—Mullet.

Cape Cod to Florida.

MUGIL LINEATUS Mitchill.—Striped mullet.

Cape Cod to Florida.

MUGIL PETROSUS Val.

Cape Hatteras to Florida.

MUGIL PLUMIERI Val.

Cape Hatteras to Florida.

70.—ATHERINIDÆ.

CHIROSTOMA NOTATA (Mitch.) Gill.—Silver-sides ; friar (*New England*).

Maine to Florida.

CHIROSTOMA MENIDIA (Linn.) Gill.

Cape Hatteras to Florida.

ATHERINA CAROLINA Val.

Cape Hatteras to Florida.

71.—BELONIDÆ.

BELONE LONGIROSTRIS (Mitch.) Gill.—Silver-gar ; bill-fish.

Cape Cod to Florida.

72.—SCOMBERESOCIDÆ.

EXOCETUS EXILIENS Gmel.—Flying-fish.

Cape Cod to Florida.

EXOCETUS NOVEBORACENSIS Mitch.

Cape Cod to Florida.

EXOCÆTUS MELANURUS Val.

Cape Cod to Florida.

HALOCYPSELUS EVOLANS (Linn.) Gill.

Cape Cod to Florida.

CYPSELURUS COMATUS (Mitch.) Weinland. (d. s., d. @ g.)

Cape Cod to Florida.

CYPSELURUS FURCATUS (Mitch.) Weinland. (d. s., d. @ g.)

Cape Cod to Florida.

EULEPTORHAMPHUS LONGIROSTRIS (Cuv. and Val.) Gill.

Cape Cod to Florida.

HEMIRHAMPHUS UNIFASCIATUS Ranzani.

Cape Cod to Florida.

SCOMBERESOX SCUTELLATUS Lesueur.—Skipper; saury; skip jack.

Nova Scotia to Florida.

73.—CYPRINODONTIDÆ.

CYPRINODON VARIEGATUS Lac.

Cape Cod to Florida.

CYPRINODON PARVUS Baird and Girard (d. @ g.)

Cape Cod to Cape Hatteras.

MICRISTIUS ZONATUS (Mitch.) Gill.

Cape Cod to Florida.

MICRISTIUS CINGULATUS (Cuv. and Val.) Gill (d. s.)

Cape Cod to Florida.

MICRISTIUS CHRYSOTUS (Gthr.) Gill (d. s.)

Cape Hatteras to Florida.

FUNDULUS HETEROCLITUS (Linn.) Gill.

Cape Cod to Florida.

FUNDULUS PISCULENTUS (Mitch.) Val.—Killi-fish; mummichog.

Maine to Florida.

FUNDULUS MULTIFASCIATUS (Lesueur) Val.

Cape Cod to Florida.

FUNDULUS NIGROFASCIATUS (Lesueur) Val.

Cape Cod to Florida.

HYDRARGYRA MAJALIS (Wallb.) Val.

Cape Cod to Cape Hatteras.

HYDRARGYRA SWAMPINA Lac. (d. s.)

Cape Hatteras to Florida.

74.—STOMIATIDÆ.

MALACOSTEUS NIGER Ayres.

Pelagic.

STOMIAS FEROX Reinhardt.

Greenland.

75.—SCOPELIDÆ.

SCOPELUS GLACIALIS Reinhardt.
Greenland.

MAUROLICUS BOREALIS (Nilsson) Gthr (d. s.)
Massachusetts.

76.—SYNODONTIDÆ.

TRACHINOCEPHALUS MYOPS (Bl. Sch.) Gill.
Cape Hatteras to Florida.

SYNODUS FOETENS (Linn.) Gill.
Cape Cod to Florida.

77.—MICROSTOMIDÆ.

MALLOTUS VILLOSUM (Müller) Cuv.—Capelin.
Polar regions to Nova Scotia.

OSMERUS MORDAX (Mitch.) Gill.—Smelt.
Nova Scotia to Cape Hatteras.

MICROSTOMA GRÆNLANDICA Reinhardt.
Greenland.

78.—SALMONIDÆ.

SALMO SALAR (Linn.) Günther.—Salmon; mishquamauquoek (*Nar-ragansett Indians*).

Polar regions to Cape Cod.

SALMO IMMACULATUS H. R. Storer. (d. s.) Sea-trout.
Labrador to Nova Scotia.

79.—PARALEPIDIDÆ.

PARALEPIS BOREALIS Reinhardt.
Greenland.

80.—ALBULIDÆ.

ALBULA CONORHYNCHUS Bloch and Schneider.—Lady-fish.
Cape Cod to Florida.

81.—ELOPIDÆ.

ELOPS SAURUS Linn.—Big-eyed herring; matajuelo blanco and real (*Cuba*).

Cape Cod to Florida.

MEGALOPS THRISSOIDES (Bl. Sch.) Günther.—Jew-fish; tarpum (*Berm.*)
Cape Cod to Florida.

82.—DUSSUMIERIDÆ.

ETRUMEUS TERES (DeKay) Brevoort.—Round herring.
Cape Cod to Cape Hatteras.

83.—CLUPEIDÆ.

BREVOORTIA MENHADEN (Mitch.) Gill.—Menhaden (*Vineyard Sound*); munnawhatteaug (*Narragansett Indians*); poggy, poghaden (*east coast of New England*); moss-bunker (*New York*); panhaden, panhagen (*New England*); hard-head, bony-fish (*Massachusetts Bay*); skippaug or bunker (*east end of Long Island*); bony-fish (*Saybrook*); white-fish (*Saybrook to Milford, Connecticut*); fat-back and yellow-tail (*coast of North Carolina*); bug-fish (*Carolina*).

Cape Cod to Cape Hatteras.

ALOSA SAPIDISSIMA (Wilson) Storer.—Shad.

Newfoundland to Florida.

OPISTHONEMA THIRISSA Gill.—Thread-herring; menhaden (*Portland*); shad-herring (*New York*).

Newfoundland to Florida.

POMOLOBUS PSEUDOHARENGUS (Wilson) Gill. — Herring (*Southern States*); alewife (*New England*); gaspereau (*British provinces*); spring-herring (*New England*); aum-suog (*Narragansett Indians*); kyack, blue-back, alewife, sawbelly, cat-thresher (*Portland, Me.*)

Newfoundland to Florida.

POMOLOBUS MEDIOCRIS (Mitch.) Gill.—Tailor herring (*Potomac*); fall-shad.

Newfoundland to Florida.

CLUPEA HARENGUS Linn.—English herring.

Polar regions to Cape Cod.

84.—DOROSOMIDÆ.

DOROSOMA CEPEDIANTUM (Lac.) Gill.—Toothed herring.

Cape Cod to Cape Hatteras.

85.—ENGRAULIDÆ.

ENGRAULIS VITTATUS (Mitch.) Bd. and Girard.—Anchovy.

Cape Cod to Cape Hatteras.

ENGRAULIS BROWNII (Gmelin) Val.—Anchovy.

Cape Cod to Florida (New York, Val).

86.—SILURIDÆ.

ÆLURICHTHYS MARINUS (Mitch.) Baird and Girard.—Fork-tailed cat-fish.

Cape Cod to Florida.

ARIOPSIS MILBERTI (Val.) Gill.—Sea cat-fish.

Cape Cod to Florida.

87.—CONGRIDÆ.

CONGER OCEANICA (Mitch.) Gill.—Conger-eel.

Newfoundland to West Indies.

88.—ANGUILLIDÆ.

ANGUILLA BOSTONIENSIS (Les.) DeKay.—Common eel.

Newfoundland to Cape Hatteras.

89.—SACCOPHARYNGIDÆ.

SACCOPHARYNX FLAGELLUM Mitch.—Gulper.

Pelagic, in deep seas, (lat. 52° N., long. 30° W.—Mitchill.)

90.—ACIPENSERIDÆ.

ACIPENSER OXYRHYNCHUS Mitch. (d. s.)—Sharp-nosed sturgeon.

Cape Cod to Florida.

ACIPENSER BREVIROSTRIS Lesueur.—Short-nosed sturgeon.

Cape Cod to Florida.

91.—CEPHALOPTERIDÆ.

CERATOPTERA VAMPIRUS (Mitch.) Gill.—Devil-fish; manta (*Cuba*).

Cape Cod to Florida.

92.—MYLIOBATIDÆ.

AETOBATIS NARINARI Müll. and Henle.—Bishop-ray; obispo (*Cuba*).

Norfolk, Virginia, to Florida.

RHINOPTERA QUADRILOBA (Les.) Cuv.—Cow-nosed ray.

Cape Cod to Florida.

MYLIOBATIS FREMENVILLEI (Les.) Storer.—Sharp-nosed ray.

Cape Cod to Florida.

93.—TRYGONIDÆ.

PTEROPLATEA MACLURA Müll. and Henle.—Butterfly-ray.

Cape Cod to Florida.

TRYGON CENTRURA (Mitch.) Gill.—Sting-ray; whip-ray; stingaree.

Cape Cod to Florida.

94.—TORPEDINIDÆ.

TORPEDO OCCIDENTALIS Storer.—Torpedo; cramp-fish; numb-fish.

Cape Cod to Florida.

95.—RAIADÆ.

RAIA EGLANTERIA Lac. Lesueur.—Clear-nosed ray.

Nova Scotia to Florida.

RAIA ERINACEUS Mitch. (d. s.)—Summer-skate.

Cape Cod to Florida.

RAIA LÆVIS Mitch.—Sharp-nosed skate; winter-skate.

Nova Scotia to Florida.

96.—PRISTIDÆ.

PRISTIS ANTIQUORUM (Linn.) Lath. (d. @ s.)—Saw-fish.

Cape Cod to Florida.

97.—SQUATINIDÆ.

SQUATINA DUMERILI Lesueur. (d. s.)—Angel-fish; shark-ray; monk, or monkey fish, kingston, shark-ray, Fiddle-fish (*Europe*); little bull-head shark (*New York*).
Cape Cod to Florida.

98.—CETORHINIDÆ.

CETORHINUS MAXIMUS Blainv. (d. @ s.)—Basking-shark; sun-fish; sail-fish; hoe-mother (*Great Britain*).
Newfoundland to Cape Hatteras.

99.—LAMNIDÆ.

ISUROPSIS DEKAYI Gill. (d. s.)—Mackerel-shark; dentuda (*Cuba*).
Newfoundland to Florida.
CARCHARODON ATWOODI (Storer) Gill. (d. s.)—Atwood's shark; man-eater (*Maine*).
Newfoundland to Florida.

100.—ODONTASPIDIDÆ.

EUGOMPHODUS LITTORALIS Gill.—Sand-shark; shovel-nose (*Maine*).
Maine to Cape Hatteras.

101.—ALOPECIIDÆ.

ALOPIAS VULPES (Linn.) Bon.—Fox-shark; threshers; swingle-tail; sea-fox; sea ape; pez zorro (*Cuba*); pesce pavone (*Naples*).
Cape Cod to Florida.

102.—SPHYRNIDÆ.

SPHYRNA ZYGÆNA (Linn.) Müll. and Henle.—Hammer-head shark; cornuda (*Cuba*); magnosa (*Naples*).
Cape Cod to Florida.
RENICEPS TIBURO (Linn.) Gill.—Shovel-head shark.
Cape Cod to Florida.

103.—GALEORHINIDÆ.

EULAMIA MILBERTII (Müll. and Henle) Gill.—Blue shark.
Cape Cod to Florida.
EULAMIA OBSCURUS (Lesueur) Gill.—Dusky shark.
Cape Cod to Florida.
APRIONODON PUNCTATUS (Mitch.) Gill.
Cape Cod to Cape Hatteras.
SCOLIODON TERRÆ-NOVÆ (Rich.) Gill.
Newfoundland to Cape Hatteras.
GALEOCERDO TIGRINUS Müll. and Henle.—Tiger-shark; alecrin (*Cuba*).
Cape Cod to Florida.
MUSTELUS CANIS (Mich.) DeKay. (d. s.)—Smooth bound (*Great Britain*); smooth dog-fish; blue-dog (*Massachusetts*); boca dulce (*Cuba*).
Cape Cod to Cape Hatteras.

104.—SPINACIDÆ.

SQUALUS AMERICANUS (Storer) Gill. (d. s.)—Picked dog-fish, dog-fish;
bone-dog; skittle-dog; hoe (*Great Britian*).

Newfoundland to Cape Hatteras.

CENTROSCYLLIUM FABRICII (Reinh.) Müll. and Henle.
Greenland.

105.—SCYMNIDÆ.

SOMNIOSUS MICROCEPHALUS (Bloch) Gill. (d. @ s.)—Sleeper-shark;
nurse (*Portland*).

Polar regions to Cape Cod.

106.—PETROMYZONTIDÆ.

PETROMYZON AMERICANUS Lesueur. (d. s.)—Lamprey; lamper eel.
Cape Cod to Cape Hatteras.

AMMOCETES NIGRICANS (Lesueur) Gill. (d. s.)—Black lamprey.
Cape Cod to Cape Hatteras.

AMMOCETES APPENDIX (DeKay) Gill. (d. s.)
Cape Cod to Cape Hatteras.

AMMOCETES BICOLOR Lesueur. (d. s.)
Cape Cod to Cape Hatteras.

107.—MYXINIDÆ.

MYXINE GLUTINOSA Linn. (d. @ s.)—Hag-fish; sucker; slime-fish.
Polar regions to Cape Cod.

108.—BRANCHIOSTOMIDÆ.

BRANCHIOSTOMA CARIBÆUM Sundevall. (d. s.)—Lancelet.
Cape Hatteras to Florida.

3.—BIBLIOGRAPHY OF EAST COAST FISHES.

I.

The following list embraces almost all the articles purporting to enumerate all the salt-water fishes found at or recorded as inhabiting a given locality, from Greenland to Florida, or (e. g. Holbrook's and Putnam's articles.) commenced with such intention; in addition, the titles of M. Felipe Poey's catalogues are given, as they are indispensable to the American ichthyologist. These articles have been arranged under the names of their authors in alphabetical order. They represent the following geographical areas, commencing with (1) the general works, and then (2) the northern areas.

GENERAL. Gill, Storer (D. H.).—DeKay's "Zoology of New York" may be added as it contains brief notices of the "extra-limital species."

NORTHERN AMERICA. Richardson.

GREENLAND. Fabricius, Reinhardt.

GULF OF ST. LAWRENCE AND BAY OF FUNDY. Fortin, Gill.

LABRADOR. Storer (H. R.)

NOVA SCOTIA. Knight, Perley, Storer (H. R.)

MAINE. Holmes.

MASSACHUSETTS. Lyman, Putnam, Smith, Storer (D. H.)

CONNECTICUT. Linsley.

NEW YORK. Ayres, DeKay, Mitchill.

NEW JERSEY. Abbott, Baird.

SOUTH CAROLINA. Holbrook, Storer.

GEORGIA. Holbrook.

In addition to these, the reports and journals of arctic travelers, and histories and geographies of countries and states may be referred to; but as the lists contained in such works are generally compilations by unscientific persons, they require to be consulted with great caution. Special mention need only be made of Bonnycastle's "Newfoundland in 1842," Belknap's "History of New Hampshire" (1793), Mather's "Geography of the State of New York" (1847), and Russell's "Harper's New-York State Class-Book" (1847).

ABBOTT (Charles Conrad). Catalogue of Vertebrate Animals of New Jersey. . .

<Geology of New Jersey. By authority of the legislature. George H. Cook, State Geologist, . . . 1868—Appendix E, or pp. 751-830. ("FISHES," pp. 803-830.)

237 species, of which 194 are marine and 43 fresh-water, are recorded; but many of the names are synonyms, and the list bears evidence of being a compilation, and must be consulted with caution.

AYRES (William O . . .). Enumeration of the Fishes from Brookhaven, Long Island, with Remarks upon the Species observed. . . . <Boston Journal of Natural History, . . . vol. IV, 1844, pp. 255-264 (September, 1842); 265-292 (April, 1843).

61 species are enumerated, including 9 fresh-water species, and observations on the characters and habits of most are recorded

4 species are enumerated as new (*Cottus variabilis* [*Cottus octodecim-spinosus*?], *Gasterosteus millepunctatus* [*Apeltes quadracus*?], *Fundulus fuscus* [= *Melanura*], and *Caricharius griseus* [= *Eugomphodus littoralis*]), the last three of which were described in a succeeding article (Description of four species [including *Leuciscus nanutus*] of Fish from Brookhaven, L. I., all of which are believed to be new), <op. cit., iv, pp. 293-303, pl. 12.

BAIRD (Spencer Fullerton). Report on the Fishes observed on the Coasts of New Jersey and Long Island during the Summer of 1854, by Spencer F. Baird, Assistant Secretary of the Smithsonian Institution. <Ninth Annual Report of the Smithsonian Institution [for 1854]. 1855, pp. 317-352 + 337.

Reprinted as a pamphlet, with an index, and the following title:

Report to the Secretary of the Smithsonian Institution, on the Fishes of the New Jersey Coast, as observed in the Summer of 1854, by Spencer F. Baird, Assistant Secretary Smithsonian Institution. From the Ninth Annual Report of the Smithsonian Institution for 1854. Washington: Beverley Tucker, Senate Printer, June, 1855. [8vo, 40 pp.]

67 species, of which 57 are marine, or brackish-water, and 10 fresh-water, were observed, and valuable notes on habits and color in a fresh state were recorded.

DEKAY (James E. . . .). Letter from J. E. DeKay, of the Zoological Department, May 7, 1839. <State of New York. . . . Communication from the Governor, transmitting Several Reports relative to the Geological Survey of the State. 1840, pp. 7-14.

A mere list of species, of no value.

—— Report of J. E. DeKay, of the Zoological Department [on the Fauna of New York. December 20, 1839]. <Ib. pp. 15-36.

A list like the preceding.

—— Zoology of New-York, or the New-York Fauna; comprising detailed descriptions of all the animals hitherto observed within the State of New-York, with brief notices of those occasionally found near its borders, and accompanied by appropriate illustrations. By James E. DeKay. Part IV. Fishes.—Albany: printed by W. & A. White & J. Visscher. 1842. [4to, xiv [1, errata], 415 pp.; atlas, 1 p. l., 79 p. l.]

Descriptions (and, in most cases, figures) of 335 nominal species are given, exclusive of the "extra-limital species" especially so designated, but including some that are really such. Of these 335 nominal species, 265 (including Labraces, Gasterosteidae, Anguillidae) are salt- or brackish-water, and 70 fresh-water.

FABRICIUS (Otto). Fauna Grœnlandica, systematice sistens animalia Grœnlandiæ occidentalis hactenus indagata, quoad nomen specificum, triviale, vernaculumque; synonyma auctorum plurimum, descriptionem, locum, victum, generationem, mores, vivum, capturamque singuli, prout detegendi occasio fuit, maximaque parte secundum proprias observationes Othonis Fabricii ministri evangelii, quondam Grœnlandis ad coloniam Friderichshaab, . . . Hafniæ et Lipsiæ, impensis Ioannis Gottlob Rothe, . . . MDCCLXXX. [8vo.]

Contains descriptions and notices of 44 species.

FORTIN (Pierre). List of the Cetacea, Fishes, Crustacea, and Mollusca, which now inhabit and have inhabited the Canadian shores of the Gulf of St. Lawrence, and are the object of fishing operations, whether on a large or small scale, and which are used as bait, &c., &c. <Annual Reports of Pierre Fortin, Esq., magistrate in command of the expedition for the protection of the fisheries in the Gulf of St. Lawrence, during the seasons of 1861 and 1862. (Quebec, 1863), pp. 109-124.

—— Continuation of the List of Fish [of] the Gulf and River St. Lawrence. <Annual Reports of Pierre Fortin, Esq., [commanding] the expedition for the protection of the fisheries in the Gulf of St. Lawrence, during the season of 1863, (pp. 60-72), 1864, (pp. 61-69), 1865, (pp. 69-79). (Quebec, 1864-1866.)

The title of each report is slightly varied.

GILL (Theodore Nicholas). Catalogue of the Fishes of the Eastern Coast of North America, from Greenland to Georgia. . . . January, 1861. [8vo, 63 pp.] Issued as an appendix to the "Proceedings of the Academy of Natural Sciences of Philadelphia, 1861."

A list of 394 nominal species, with references, to facilitate identification, to Storer's *Synopsis of the Fishes of North America*, and, for species not mentioned therein, to other authorities.

——— *Synopsis of the Fishes of the Gulf of St. Lawrence and Bay of Fundy.* . . .
 <The Canadian Naturalist and Geologist: a bi-monthly journal of natural science, conducted by a committee of the Natural History Society of Montreal. New series, vol. II, pp. 244-266; August, 1865.

A list of 95 species, of which 81 are marine and brackish, and 14 fresh-water. Dichotomous synoptical tables are given of the orders, suborders, and families, and brief diagnoses of the genera and (where more than one in the genus) of the species.

HOLBROOK (John Edwards). *Southern Ichthyology; or, A Description of the Fishes Inhabiting the waters of South Carolina, Georgia, and Florida.* By John Edwards Holbrook, M. D., Professor of Anatomy in the Medical College of the State of South Carolina; [etc.] Illustrated with colored engravings, done from life, by J. H. Richard. New York and London: Wiley & Putnam. 1847. No. II. [4to, pp. 1-32, pl. 1-4.]

No others published.

——— [Catalogue of the Fish of the State of Georgia.] <Statistics of the State of Georgia: . . . By George White.—Savannah: W. Thorne Williams. 1849. (Catalogue of the Fauna and Flora of the State of Georgia. Prepared for this work by eminent naturalists. pp. 16-20.)

A list, without notes or remarks, of 140 species, 117 of which are salt- or brackish-water, and 23 fresh-water (excluding the eel).

——— *Ichthyology of South Carolina.* By John Edwards Holbrook, M. D., Professor of Anatomy in the Medical College of the State of South Carolina; [etc.] Charleston, S. C.: published by John Russell. 1855. [4to, title, pp. 1-182, pl. 1-27.]

Issued in numbers, and terminating in the middle of the description of "*Saurus falcatus*." Descriptions of 52 species and illustrations of 54 are given.

——— *Ichthyology of South Carolina.* By John Edwards Holbrook, M. D., [etc.] Vol. I. Charleston, S. C.: published by Russell & Jones. 1860. [4to, title, 4 p. l. (preface), 205 pp., 28 pl.]

This edition was also issued in numbers (10), and was printed by Welch, Bigelow & Co., Cambridge. The descriptions and sequence, with some slight modifications, are the same as in the previous editions, but the plates are new. 56 species are described and illustrated, of which 48 are marine and 8 fresh-water.

A collation of both editions of Holbrook's work is given in a "Review of Holbrook's *Ichthyology of South Carolina*," [by Theodore Gill,] in the *American Journal of Science and Arts* (Silliman's), 2d series, vol. XXXVII, pp. 89-94, January, 1864.

HOLMES (Ezekiel). *Dr. Holmes' Report on the Fishes of Maine, including some of the Elementary Principles of Ichthyology.* (<Part I. Reports upon the Zoology and Botany of the State of Maine.) <Second Annual Report upon the Natural History and Geology of the State of Maine. 1862. pp. 11-117.

The "Second Annual Report upon the Natural History and Geology of the State of Maine, 1862," although pagged separately (pp. 1-447), had only this—a bastard-title, and formed an appendix to (although not so specified), and was bound with the "Seventh Annual Report of the Secretary of the Maine Board of Agriculture, 1862. Augusta: Stevens & Sayward, Printers to the State. 1862."

The list of fishes embraces 76 species, and was principally based on a manuscript; of this number, 57 were marine and brackish-water, and 19 fresh-water.

KNIGHT (Thomas F . . .). [1] *Descriptive Catalogue of the Fishes of Nova Scotia.* By Thomas F. Knight. . . . *E mari merces.* Published by direction of the Provincial Government.—Halifax, N. S. Printed by A. Grant, Printer to the Queen's Most Excellent Majesty. 1866. [8vo, 54 pp.]

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51 nominal species of fishes are enumerated and (in most cases described) observations on habits, &c., recorded; 44 of the species are salt- or brackish-water forms, and 7 fresh-water.

— [2] Shore and Deep Sea Fisheries of Nova Scotia. By Thomas F. Knight, . . . *E mari merces*. Published by direction of the Provincial Government.—Halifax, N. S. Printed by A. Grant, Printer to the Queen's Most Excellent Majesty. 1867. [8vo, vi (1 l.), 113 pp.]

With pinkish paper-covers, respectively entitled, at middle half (1, 2), Pamphlets on the Fishes and Fisheries of Nova Scotia. (1)—No. I. Fishes of Nova Scotia, and (2)—No. II. Shore and Deep Sea Fisheries.

As indicated by the title, this report is chiefly devoted to the fisheries from an economical and political point of view.

LINSLEY (James Harvey). Catalogue of the Fishes of Connecticut, arranged according to their natural families; prepared for the Yale Natural History Society, . . . <The American Journal of Science and Arts. Conducted by B. Siliman. (New Haven), xlvii, 1844, pp. 55-80.

A list of 173 nominal species, of which 148 are salt- or brackish-water, and 25 fresh-water.

LYMAN (Theodore). Fishes taken in the Waquoit Wier, April 18 to June 18, 1871. Sixth Annual Report of the Commissioners on Inland Fisheries for the year ending January 1, 1872. Boston: Wright & Potter, State Printers, . . . 1872.

"Most of the nomenclature is by Dr. Franz Steindachner; and some notes by Professor Agassiz are added, marked Ag."

The list enumerates 44 species, and is enriched with observations on the economical relations and habits of some of the species.

MITCHILL (Samuel Latham). Report, in part, of Samuel L. Mitchill, M. D., Professor of Natural History, &c., on the Fishes of New-York.

I. Apodal.—Eel—silver-fish.

II. Jugular.—Cod—blenny—stomodon.

III. Thoracic.—Flounder—sea-basse—mackerel—gurnard—dolphin.

IV. Abdominal.—Salmon—pike—clops—silver-side—mullet—flying-fish—polynemus—herring—carp—perch—black-fish—bergal—striped basse—weak-fish.

V. Chondropterygious.—Sturgeon—shark—ray—lamprey.

VI. Branchiostegious.—Toad-fish—sun-fish—sea-horse—fishing-frog.

* * Those marked thus * have been described from fresh specimens; with this note ♂ ♀ are supposed to be species unknown to the systems, or not plainly enough described; and by this sign ♀ may be used for human food.

The new genera are four. *Stomodon* [= *Merlucius* Raf.], *Morone*, *Tautoga*, and *Roccus*.

A very considerable number of fishes, well known to the author of these beginnings of an attempt, are not even named in the present list, because they have not come to hand during the few weeks that have elapsed since its commencement. Such are the pond-fish, king-fish, sheeps-head, and a multitude more.

New York: printed by D. Carlisle, No. 301 Broadway, January 1, 1814. [12mo, 28 pp., including title.]

To avoid all doubt, it may be specifically stated that the title above given is an exact transcript (kindly furnished by Mr. Brevoort) of the title-page of the work.

— The Fishes of New York, described and arranged. . . . <Transactions of the Literary and Philosophical Society of New-York: . . . , vol. I, 1815, pp. 355-492, pl. 1-6.

In the introductory remarks, 147 species (and, in addition, 19 varieties) are summed up. These are arranged according to Shaw's modification of the Linnean system, and the generic diagnoses are mostly copied (sometimes with slight verbal modifications)

from Shaw's work. 60 of the species are illustrated (mostly from drawings by Dr. Akerly, a brother-in-law of Dr. Mitchill) on 6 steel-plates.

The preceding work appears to have been translated into French by F. J. Meisser, a physician of Brussels, it being apparently the work referred to under the title: "Mémoire sur l'ichthyologie de l'Amérique Septentrionale, par Mitchill, traduction de l'anglais," in Vandermaelen's *Dictionnaire des hommes des lettres, des savans et des artistes de la Belgique* (1837), p. 29. I have never seen the work.

— Memoir on Ichthyology. The Fishes of New York described and arranged. In a supplement to the Memoir on the same subject, printed in the New-York Literary and Philosophical Transactions, vol. I, pp. 355-492. By Samuel L. Mitchill. <The American Monthly Magazine and Critical Review, vol. II (New-York: 1817-1818), pp. 241-248 (February, 1818); 321-328 (March, 1818).

In this supplement 42 nominal species are added, of which 31 are given as marine and 11 are enumerated as fresh-water; but two of the latter ("the fresh-water eel," and "long-jawed fresh-water pike," or *Belone*) are really rather salt- or brackish-water species.

PERLEY (M . . . H . . .). Report upon the Fisheries of the Bay of Fundy. By M. H. Perley, Esquire, Her Majesty's Emigration Officer at Saint John, New Brunswick, . . . Fredericton: J. Simpson, Printer to the Queen's Most Excellent Majesty. 1851. [8vo, viii, 176 pp.]

Contains a list of 55 nominal species, of which 42 are salt-water and 13 fresh-water.

— Descriptive Catalogue [in part] of the Fishes of New Brunswick and Nova Scotia, by M. H. Perley, Esquire, Her Majesty's Emigration Officer at Saint John, New Brunswick. [Second edition.] Fredericton: J. Simpson, Printer to the Queen's Most Excellent Majesty. 1852. [8vo, cover-title, 50 pp.]

Contains a list of 62 nominal species, of which 49 are salt-water and 13 fresh-water. It is a second edition of the catalogue in the preceding work (pp. 118-159).

POEY (Felipe). *Conspectus Piscium cubensium*. Extrait des *Memorias sobre la Historia natural de la isla de Cuba*, tome 2^e, dont la pagination a été conservée. Par Felipe Poey. Habana, 1861: imprenta de la viuda de Bareina y compañía, calle de la Reina, num. 6. [8vo, title, pp. 357-404.]

An extract from the following work:

— *Memorias sobre la Historia natural de la isla de Cuba, acompañadas de sumarios latinos, y extractos en Frances*. Por Felipe Poey, catedrático de zoología y de anatomía comparada de la real universidad de la Habana, y socio fundador de la Sociedad Entomológica de Francia. Toma 2^a. Habana: imprenta de la viuda de Bareina, calle de la Reina, num. 6, 1856-1858.

— *Synopsis Piscium cubensium*. Catalogo razonado de los peces de la isla de Cuba, extractado del Repertorio fisico-natural de la isla de Cuba, Director Felipe Poey, tome 2^a, página 279 y siguientes [-465]. Por Felipe Poey. Habana, 1868: imprenta de la viuda de Bareina y comp^a, calle de la Reina, No. 6. [8vo, 1 title, pp. 279-465.]

Although primarily catalogues of Cuban, and therefore extra-limital, forms, they are almost indispensable to the investigator of the North American species.

PUTNAM (Frederick Ward). [Fishes of Essex County, Massachusetts.] <Proceedings of the Essex Institute, vol. I, pp. 144, 148, 201, . . . 1855-'6.

Discontinued after the third article; 22 species (Percidae—Scombridae) were enumerated.

REINHARDT (Johan). Fortegnelse over Grönlands Pattedyr, Fugle og Fiske, . . . <RINK (H . . .) Grönland, geografisk og statistisk beskrevet. Kjöbenhavn, 1857.

Reprinted (from same types) with rest of natural history in the following work :

Naturhistoriske Bidrag til en Beskrivelse af Grønland, af J. Reinhardt, J. C. Schiödte, O. A. L. Mörch, C. F. Lütken, J. Lange, H. Rink . . . Kjöbenhavn. Louis Kleins Bogtrykkeri. 1857, (pp. 20-27.)

A nominal list of 69 species, with references to original descriptions, or to the *Fauna Grænlantica* of Fabricius, and with the names current among the Esquimaux. Only four of the species (*Salmonidæ*) are fresh-water.

The same list (but without the references to authorities) was translated and published in Etzel's (Anton von) Grönland geographisch und statistisch beschrieben. Aus dänischen Quellschriften. Stuttgart, J. G. Cotta'scher Verlag. 1860. (pp. 582-584.)

RICHARDSON (John). *Fauna Boreali-Americana; or, the Zoology of the Northern Parts of British America: containing Descriptions of the Objects of Natural History Collected on the late Northern Land Expeditions under the command of Captain Sir John Franklin, R. N. Part third. The Fish.* By John Richardson, M. D., F. R. S., F. L. S., . . . , Surgeon and Naturalist to the Expeditions. Illustrated by numerous plates. Published under the authority of the Right Honourable the Secretary of State for Colonial Affairs.—London: Richard Bentley, New Burlington street. MDCCCXXXVI. [4to, xv, 327 (+1) pp., 24 pl. (numbered 74-97).]

SCHÖEPFF (Johann David). Beschreibung einiger nord-amerikanischer Fische, vorzüglich aus den Neu-Yorkischen Gewässern, . . . <Schriften der Gesellschaft naturforschender Freunde zu Berlin. viii, 138-194, 1788.

SMITH (Jerome Van Crowninshield). *Natural History of the Fishes of Massachusetts, embracing a practical essay on angling.* By Jerome V. C. Smith, M. D. [Cut.] Boston: Allen and Ticknor. 1833. [12mo, vii, 309 (+1) pp.]

An exceptionally and even ludicrously erroneous and worthless compilation. Its character was exposed in "Remarks on the 'Natural History of the Fishes of Massachusetts, . . .' Read before the Boston Society of Natural History, March 20, 1839. By D. Humphreys Storer, M. D. <American Journal of Science and Arts (Silliman's), vol. XXXVI, July, 1839, pp. 337-349." According to Dr. Storer (p. 348), the work of his compatriot contains "notices of 105 species, of which 80 are foreigners, and but 25 are found in the waters of our State. Of these 105 species, 36 are illustrated by figures; of these 36 illustrations, but 9 accompany species which are found on our coast; of these 9 figures, 6 are copied from 'Strack's Plates,' and 3 from Mitchill's 'Fishes of New York;' of the 36 illustrations [small wood-cut figures] contained in this 'History,' not one is drawn from nature."

— A Catalogue of the Marine Fishes taken on the Atlantic Coast of Massachusetts. . . . [Also, "Fishes found in the Rivers, Mountain-Streams and Ponds of Massachusetts."] <Report on the Geology, Mineralogy, Botany, and Zoology of Massachusetts, . . . By Edward Hitchcock, . . . Boston, 1833, pp. 553-554.

A list of 52 nominal species of marine and 17 of fresh-water fishes.

— [Revised Catalogue of the Fishes of Massachusetts.] <Op. cit., 1833, pp. 597-598.

A list of 102 nominal species, 83 of which (including the Bodiani=Morone) are salt- or brackish-water, and 19 fresh-water.

— A Catalogue of the Marine and Fresh-Water Fishes of Massachusetts, . . . <Op. cit., second edition. Boston, . . . , 1835, pp. 534-538.

A list of the same character as the preceding, enumerating 106 nominal species (and 2 varieties), of which 89 are salt- or brackish-water, and 17 fresh-water. Reproduced (pp. 15-18) in the "Catalogues of the Animals and Plants of Massachusetts." (Edited by Edward Hitchcock), Amherst, 1835, reprinted (same type) from the second edition of the above-cited work.

The catalogue is a repetition of the names (without descriptions or remarks) of the author's "Natural History of the Fishes of Massachusetts."

This compilation was also criticised (by Dr. D. H. Storer) in 1837 in "An Examination of the 'Catalogue of the Marine and Fresh-water Fishes of Massachusetts,' by J. V. C. Smith, M. D.," contained in Professor Hitchcock's "Report on the Geology, Mineralogy, &c., of Massachusetts. By D. Humphreys Storer, M. D." <Boston Journal of Natural History, . . . vol. I, pp. 347-365, pl. viii (May, 1836).

STORER (David Humphreys). A Report on the Fishes of Massachusetts. By D. Humphreys Storer, M. D. <Boston Journal of Natural History, . . . , vol. II, 1839, pp. 289-558, pl. vi-viii.

Descriptions are given of 107 nominal species, 91 of which are salt- or brackish-water, and 16 fresh-water; in the concluding remarks, 9 additional undeterminate species are indicated as probable inhabitants of the Massachusetts waters.

— Supplement to the Ichthyological Report. <Ib., vol. III, 1841, pp. 267-273.

— Additional Descriptions of, and Observations on, the Fishes of Massachusetts. 1842/ <Ib., IV, 1844, pp. 175-190.

A second supplement to the report.

— Reports on the Ichthyology and Herpetology of Massachusetts. By D. Humphreys Storer, M. D. . . . <Reports on the Fishes, Reptiles, and Birds of Massachusetts. Published agreeably to an order of the legislature, by the commissioners on the zoological and botanical survey of the State. Boston: Dutton & Wentworth, State Printers. 1839. [8vo, xii [+ 2 l.], 426 pp., 4 pl.], pp. 1-253, with half-title,—Fishes of Massachusetts,—pp. 1-202, pl. 1-3.

The report on the fishes is the same as that published in the "Boston Journal of Natural History," but (1) an entirely different introduction is added, (2) the supplementary observations on "*Carcharias obscurus*" (B. J., III, 558) are omitted, and (3) supplementary observations are added (pp. 405-409) on several species.

The plates are apparently printed from the same lithographic stones.

— A Synopsis of the Fishes of North America. . . . <Memoirs of the American Academy of Arts and Sciences. New series. Vol. II. (Cambridge, 1846), pp. 253-550.

739 nominal species from all North America (including the West Indies) are described. The descriptions, however, are mostly inaptly compiled and insufficient.

— A Synopsis of the Fishes of North America. By David Humphreys Storer, M. D., A. A. S., . . . Cambridge: Metcalf and Company, printers to the university. 1846. [4to, 1 p. l. (—title), 298 pp.]

A reprint, with separate pagination, title-page, and index, of the preceding.

— [Catalogue of the Fishes of South Carolina.] <Report on the Geology of South Carolina. By M. Tuomey, . . . Columbia, S. C. . . . 1848. Appendix.—Catalogue of the Fauna of South Carolina. [Edited by Lewis R. Gibbes. pp. i-xxiv]—4. Class. Fishes. [By D. H. Storer, pp. x-xiii.]

A nominal list of 140 species (23 of which are fresh-water species), representing 90 genera, is given; it is little trustworthy.

— A History of the Fishes of Massachusetts. By David Humphreys Storer. <Memoirs of the American Academy of Arts and Sciences (Boston), new series, viz:—
(1.) V, pp. 49-92, pl. 1-8, 1853;
(2.) V, pp. 122-168, pl. 9-16, 1853;
(3.) pp. 257-296, pl. 17-23, 1855;
(4.) VI, pp. 309-372, pl. 24-29, 1858;
(5.) VIII, pp. 389-434, pl. 30-35, 1863;
(6.) IX, pp. —, pl. 36-39, 1867.

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134 species are described and (except one—the *Pholis subbifurcatus*—*Eumecogrammus subbifurcatus*) illustrated, and, in an appendix, a nominal list (by Mr. Frederick Putnam, of Salem) of 21 additional species is published. Of the 134 species, 116 are salt- or brackish-water, and 18 fresh-water.

— A History of the Fishes of Massachusetts. By David Humphreys Storer, M. D., A. A. S. . . . (Reprinted from the Memoirs of the American Academy of Arts and Sciences.)—Cambridge and Boston: Welch & Bigelow and Dakin & Metcalf. 1867. [4to, 2 p. l., 287 pp., 39 pl.—pl. 39 folded.]

As indicated on the title-page, a reprint of the preceding, or rather a collection of extras of the several parts of that work separately and consecutively paged, and with independent title-page and index.

STORER (Horatio Robinson). Observations on the Fishes of Nova Scotia and Labrador, with Descriptions of New Species. . . . (1850). <Boston Journal of Natural History, VI, 1857, pp. 247-270, pl. 7-8.

A list of 29 species.

II.

The following titles of articles by the author are appended for the purpose of affording ready reference to papers wherein are given the reasons for many of the changes in the nomenclature of the species enumerated in the catalogue. The articles are designated in the sequence adopted in the classification used in the catalogue. The arguments for the adoption of the names used for the species of several families, in most cases, are given in the articles on those families cited.

GILL (Theodore Nicholas). Synopsis of the Pleuronectoids of the Eastern Coast of North America. . . . <Proceedings of the Academy of Natural Sciences of Philadelphia, 1864, pp. 214-224.

— Synopsis of the North American Gadoid Fishes. . . . <P. 1863, pp. 242-254.

— Synopsis of the Family of the Lycodoidæ. . . . <P. 1863, pp. 254-262.

— On the cranial characteristics of *Gadus* [*Microgadus*] *proximus*, Grd. [type of the genus *Microgadus*]. . . . <P. 1865, p. 69.

— Synopsis of the Uranoscopoids. . . . <P. 1863, pp. 108-117.

— Synopsis of the Cyclopteroids of Eastern North America. . . . <P. 1864, pp. 189-194.

— On the Gobioids of the Eastern Coast of the United States. . . . <P. 1863, pp. 257-271.

— Note on the Species of *Sebastes* of the Eastern Coast of North America. . . . <P. 1863, pp. 333-335.

— Description of a New Species of *Chærojulis* from North Carolina. . . . <P. 1863, pp. 205-207.

— Synopsis of the Carangoids of the Eastern Coast of North America. . . . <P. 1862, pp. 430-443.

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SMITHSONIAN MISCELLANEOUS COLLECTIONS.

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THE

CONSTANTS OF NATURE.

SPECIFIC GRAVITIES, BOILING POINTS,
AND MELTING POINTS.

FIRST SUPPLEMENT TO PART I.

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JOSEPH HENRY,
Secretary Smithsonian Institution.

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PREFACE.

THE following supplement to Part I of the Constants of Nature, contains, in addition to determinations published during the past two years, some materials which were overlooked in compiling the original work. In it data are given for nearly seven hundred substances, of which at least four hundred are new since the publication of Part I.

Of course the compiler is anxious that his work should be as thorough as possible, and hence he will be greatly obliged to any person calling his attention to errors or omissions. He would also request investigators having unpublished determinations on hand to favor him with copies of them for use in subsequent supplements or editions. Such material is always worth saving, even when it is not of sufficient value to warrant publishing by itself.

Few explanations are needed in this supplement. The arrangement and abbreviations are the same which were originally used, with the exception of a very few new titles for periodicals. These are abbreviated as follows:—

B. D. C. G. "Berichte der Deutschen Chemischen Gesellschaft."

B. H. A. S. F. "Bulletin Hebdomadaire de l'Association Scientifique de France."

C. C. or C. Cent. "Chemisches Centralblatt." All references to this periodical apply only to the third or current series.

Fortsch. d. Phys. "Fortschritte der Physik."

F. W. C.

CINCINNATI, March 9, 1876.

SUPPLEMENT

TO

TABLES OF SPECIFIC GRAVITY, BOILING POINT AND MELTING POINT.

I. ELEMENTARY SUBSTANCES.

Name.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Bromine.			5.-24°.5.
² Sodium.	0.97.		
³ "	0.9743. 10°.		
⁴ "	0.9735. 13°. 5.		
⁵ Potassium.	0.8750. 13°.		
⁶ "	0.8766. 18°.		
⁷ Silver.			1032°.
⁸ "	10.1053. Slowly cooled from fusion.		
⁹ "	10.5513. Ditto. Rolled.		
¹⁰ "	10.4476. Hammered.		
¹¹ "	9.6323. Granulated.		
¹² "	9.8463. Brittle.		
¹³ "	9.5538. Cryst. in laminæ.		
¹⁴ "	10.4913. Wire.		
¹⁵ "	10.5700. Solid.		
¹⁶ "	9.4612. Molten.		

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		¹⁶ Roberts. C. N. 31. 143.

SPECIFIC GRAVITY TABLES.

Name.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Sulphur.	1.87. Amorph. Yellow. }		
² "	1.91-1.93. " Brown. }		
³ "	2.069. Native.		
⁴ "	2.0748. 0°. Cryst.		
⁵ Selenium.	4.406. 21°. Cryst.		
⁶ "	4.495. Gray. }		
⁷ "	4.514. " Granular. }		
⁸ "	4.77. } Laminated.		
⁹ "	4.79. } From alkaline		
¹⁰ "	4.86. } selenides.		
¹¹ "	4.418. } Cryst.		
¹² "	4.54. } From carbon di-		
¹³ "	4.59. } sulphide.		
¹⁴ "	4.27-4.34. Amorphous.		
¹⁵ "	4.29-4.36. Melted.		
¹⁶ Barium.	3.75.		
¹⁷ Lead.	11.1603.		
¹⁸ "	11.3775. Wire.		
¹⁹ "	11.361. 70°. }		
²⁰ "	11.07. Molten. }		
²¹ "	11.335. 0°.		
²² Iron.	7.761. Wire.		
²³ Copper.			1236°.
²⁴ "	8.4525. Slowly cooled from fusion.		
²⁵ "	8.902. 0°. Plate.		

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⁹ Rammelsberg. P. A. 152. 154.		²⁵ Quincke. P. A. 97. 396.

Name.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Copper.	8.9565. 17°. }		
² " "	8.945. 0°. }		
³ Palladium.	12.0.		
⁴ " "	12.104.		
⁵ Platinum.	21.504. 17°.6.		
⁶ Iridium.	22.421. 17°.5.		
⁷ Zinc.		1035°.	
⁸ Cadmium.	8.6689. Wire.		
⁹ Mercury.	13.6078. 0°.		
¹⁰ " "	13.582. 5°-10°. }		
¹¹ " "	13.570. 10°-15°. }		
¹² " "	13.558. 15°-20°. }		
¹³ Phosphorus.	1.83676. 0°. }		
¹⁴ " "	1.82321. 20°. }		
¹⁵ " "	1.80681. 44°. }		44°.4.
¹⁶ " "	1.74924. 40°. }		
¹⁷ " "	1.6949. 100°. }		
¹⁸ " "	1.6027. 200°. }		
¹⁹ " "	1.52867. 280°. }		
²⁰ " Amorphous.	2.34. 0°. }		
²¹ " " "	2.148. 0°. Prepared at 265°.		
²² " " "	2.19. 0°. " " 360°.		
²³ " " "	2.293. 0°. " " 500°.		

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397.	D. C. G. 8. 70.	

Name.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Gold.	19.2945. Unrolled. }		
² " "	19.2982. Rolled. }		
³ Carbon. Diamond.	3.51432. 18°.1.		
⁴ " "	3.5143.		
⁵ " "	3.529. 15°.		
⁶ " Charcoal from sugar.	1.81-1.85.		
⁷ Tin.	7.2914.		
⁸ " "	7.3395. Wire.		
⁹ " "	7.143. } Reduced by H. from		
¹⁰ " "	7.166. } stannous chloride. }		
¹¹ " "	7.195. Precipitated.		
¹² " "	7.310. After Fusion.		
¹³ Cerium.	6.628. Electrolytic. }		{ Between Sb & Ag.
¹⁴ " "	5.728. After Fusion. }		
¹⁵ Lanthanum.	6.049. }		
¹⁶ " "	6.163. } Electrolytic.		
¹⁷ Didymium.	6.544. Electrolytic.		

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II. FLUORIDES, CHLORIDES, BROMIDES, AND IODIDES.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Strontium fluoride.	Sr F ₂ .	4.210.	64°-66°.	
² Lead "	Pb F ₂ .	8.241.		
³ Arsenic trifluoride.	As F ₃ .	2.66. 1.		
⁴ Potassium titanofluoride	K ₂ Ti F ₆ . H ₂ O.	2.992.		
⁵ Copper "	Cu Ti F ₆ . 4H ₂ O.	2.529.		
⁶ Ammoniumstannofluoride.	Am ₂ Sn F ₆ .	2.887.		
⁷ Potassium "	K ₂ Sn F ₆ . H ₂ O.	3.053.		
⁸ Manganese "	Mn Sn F ₆ . 6H ₂ O.	2.307.		
⁹ Cobalt "	Co Sn F ₆ . 6H ₂ O.	2.604.		
¹⁰ Potassium zirconofluoride.	K ₂ Zr F ₆ .	3.582.		
¹¹ Nickel "	Ni Zr F ₆ . 6H ₂ O.	2.227.		
¹² Zinc "	Zn Zr F ₆ . 6H ₂ O.	2.255.		
¹³ Potassium tantalofluoride.	K ₂ Ta F ₇ .	4.056.		
¹⁴ " niobofluoride.	K ₂ Nb O F ₅ . H ₂ O.	2.813.	100°-101° 5.	24° 7.
¹⁵ Copper "	Cu Nb O F ₅ . 4H ₂ O.	2.750.		
¹⁶ Iodine monochloride.	I Cl.	3.263. 0°		
¹⁷ Sodium chloride.	Na Cl.	2.06-2.08.		
¹⁸ " "	"	2.155. 15° 5.		
¹⁹ " "	"	1.612. 960°.		
²⁰ " "	"	"		
²¹ Potassium "	K Cl.	1.918. 15° 5.		
²² " "	"	1.90-1.91.		
²³ " "	"	1.612. 730°.		
²⁴ " "	"	"		
²⁵ Ammonium chloride.	N H ₄ Cl.	1.52. 15° 5.		730°.

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	(2). 10. 566.	

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Sulphur chloride.	S ₂ Cl ₂ .	1.6970. 5°-10°.		
² " "	"	1.6882. 10°-15°.		
³ " "	"	1.6793. 15°-20°.		
⁴ Strontium "	Sr Cl ₂ .	3.054.		
⁵ " "	"	2.770. 910°.		
⁶ " "	"			
⁷ Barium "	Ba Cl ₂ .	3.7. 17°-5.		
⁸ Lead "	Pb Cl ₂ .			
⁹ Manganese "	Mn Cl ₂ .	2.478.		
¹⁰ Zinc "	Zn Cl ₂ .			
¹¹ Phosphorus trichloride.	P Cl ₃ .	1.6091. 5°-10°.	75°-9	
¹² " "	"	1.6001. 10°-15°.		
¹³ " "	"	1.5911. 15°-20°.		
¹⁴ " "	"	1.61294. 0°.		
¹⁵ " "	"	1.46919. 75°-9.		
¹⁶ Antimonic chloride.	Sb Cl ₃ .		121°.	-6°.
¹⁷ Perchlorethylene.	C ₂ Cl ₄ .	1.6595. 0°.		
¹⁸ Silicon tetrachloride.	Si Cl ₄ .	1.5083. 5°-10°.		
¹⁹ " "	"	1.4983. 10°-15°.		
²⁰ " "	"	1.4484. 15°-20°.		
²¹ Titanium "	Ti Cl ₄ .	1.7487. 5°-10°.		
²² " "	"	1.7403. 10°-15°.		
²³ " "	"	1.7322. 15°-20°.		
²⁴ Tin "	Sn Cl ₄ .	2.2618. 5°-10°.		
²⁵ " "	"	2.2492. 10°-15°.		
²⁶ " "	"	2.2368. 15°-20°.		
²⁷ Potassium palladiochloride.	K ₂ Pd Cl ₆ .	2.806. }		
²⁸ " "	"	2.739. }		
²⁹ Ammonium "	Am ₂ Pd Cl ₆ .	2.418.		
³⁰ Nickel "	Ni Pd Cl ₆ . 6H ₂ O.	2.353.		
³¹ Magnesium "	Mg Pd Cl ₆ . 6H ₂ O.	2.124.		
³² Zinc "	Zn Pd Cl ₆ . 6H ₂ O.	2.359.		

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SPECIFIC GRAVITY TABLES.

11

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Ammonium platin-chloride.	$\text{Am}_2 \text{Pt Cl}_6$	3.065.		
² Sodium "	$\text{Na}_2 \text{Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.500.		
³ Magnesium "	$\text{Mg Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.437.		
⁴ " "	$\text{Mg Pt Cl}_6 \cdot 12\text{H}_2\text{O}$	2.060.		
⁵ Manganese "	$\text{Mn Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.692.		
⁶ " "	$\text{Mn Pt Cl}_6 \cdot 12\text{H}_2\text{O}$	2.112.		
⁷ Iron "	$\text{Fe Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.714.		
⁸ Copper "	$\text{Cu Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.734.		
⁹ Cadmium "	$\text{Cd Pt Cl}_6 \cdot 6\text{H}_2\text{O}$	2.882.		
¹⁰ Barium "	$\text{Ba Pt Cl}_6 \cdot 4\text{H}_2\text{O}$	2.868.		
¹¹ Lead "	$\text{Pb Pt Cl}_6 \cdot 3\text{H}_2\text{O}$	2.681.		
¹² Cadmium ammonio chloride.	$\text{Cd Cl}_2 \cdot 2\text{N H}_3$	2.632.		
¹³ Barium zinc chloride.	$2\text{BaCl}_2 \cdot \text{ZnCl}_2 \cdot 4\text{H}_2\text{O}$	2.845.		
¹⁴ Barium cadmium chloride.	$\text{BaCl}_2 \cdot \text{Cd Cl}_2 \cdot 4\text{H}_2\text{O}$	2.968.		
¹⁵ Phosphorus oxychloride.	P O Cl_3	1.71185. 0°.	107°23.	
¹⁶ " "	"	1.6936. 10°.		
¹⁷ " "	"	1.6181. 51°.		
¹⁸ " "	"	1.51008. 107°23		
¹⁹ Phosphorus sulphochloride.	P S Cl_3	1.66816, 0°.	125°.	
²⁰ Pyrophosphoric chloride.	$\text{P}_2 \text{O}_5 \text{Cl}_4$	1.58. 7°.	210°215°	
²¹ Sulphur bromide.	S Br_2	2.63.		
²² Antimony tribromide.	Sb Br_3	3.473, 96° L.	283°.	90°.
²³ Bismuth "	Bi Br_3			198°202°
²⁴ Barium cadmium bromide.	$\text{BaBr}_2 \cdot \text{CdBr}_2 \cdot 4\text{H}_2\text{O}$	3.687.		
²⁵ Mercury hydrogen "	$\text{HgBr}_2 \cdot \text{HBr} \cdot 4\text{H}_2\text{O}$	3.17. Fused.		13°.

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Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point
¹ Nickel ammoniobromide.	Ni Br ₂ . 6 N H ₃ .	1.837.		
² Cadmium "	Cd Br ₂ . 2 N H ₃ .	3.366.		
³ Potassium stannobromide.	K ₂ Sn Br ₆ .	3.783.		
⁴ Ammonium "	Am ₂ Sn Br ₆ .	3.505.		
⁵ Strontium platinbromide.	Sr Pt Br ₆ . 9 H ₂ O.	2.923.		
⁶ Barium "	Ba Pt Br ₆ . 10 H ₂ O.	3.713.		
⁷ Lead "	Pb Pt Br ₆ .	6.025.		
⁸ Sodium "	Na ₂ Pt Br ₆ . 6 H ₂ O.	3.323.		
⁹ Potassium "	K ₂ Pt Br ₆ .	4.541.		
¹⁰ Ammonium "	Am ₂ Pt Br ₆ .	4.200.		
¹¹ Manganese "	Mn Pt Br ₆ . 12 H ₂ O.	2.759.		
¹² Cobalt "	Co Pt Br ₆ . 12 H ₂ O.	2.762.	Two samples.	
¹³ " "	" "	2.634.		
¹⁴ Nickel "	Ni Pt Br ₆ . 6 H ₂ O.	3.715.		
¹⁵ Magnesium "	Mg Pt Br ₆ . 12 H ₂ O.	2.802.		
¹⁶ Zinc "	Zn Pt Br ₆ . 12 H ₂ O.	2.877.		
¹⁷ Phosphorus sulphobromide.	P S Br ₃ .	2.87.		36.°4.
¹⁸ Potassium iodide.	K I.	2.497, 666.°		
¹⁹ " "	"			666.°
²⁰ Silver "	Ag I.	5.406, 450.° Molten.		
²¹ " "	"	5.8167, 116.°		
²² " "	"	5.561. Cryst.		
²³ " "	"	5.681, 0° After boiling in water.		
²⁴ " "	"	5.812. By solution Ag in H I.		
²⁵ Carbon tetriodide.	C I ₄ .	4.32, 20.°2.		450.°
²⁶ Sodium platiniodide.	Na ₂ Pt I ₆ . 6H ₂ O.	3.707.		
²⁷ Potassium "	K ₂ Pt I ₆ .	5.031.		

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SPECIFIC GRAVITY TABLES.

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Ammoniumplatiniodide	Am, Pt I ₆ .	4.610.		
² Manganese	Mn Pt I ₆ . 9 H ₂ O.	3.604.		
³ Iron	Fe Pt I ₆ . 9 H ₂ O.	3.455.		
⁴ Cobalt	Co Pt I ₆ . 9 H ₂ O.	3.618.		
⁵ "	Co Pt I ₆ . 12 H ₂ O.	3.048.		
⁶ Nickel	Ni Pt I ₆ . 6 H ₂ O.	3.976.		
⁷ "	Ni Pt I ₆ . 9 H ₂ O.	3.549.		
⁸ Zinc	Zn Pt I ₆ . 9 H ₂ O.	3.689.		
⁹ Magnesium	Mg Pt I ₆ . 9 H ₂ O.	3.458.		
¹⁰ Nickel ammonioiodide	Ni I ₂ . 6 N H ₃ .	2.101.		

III. OXIDES AND SULPHIDES.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹¹ Ice.	H ₂ O.	0.91674.		
¹² Lead dioxide.	Pb O ₂ .	9.045.		
¹³ Hematite.	Fe ₂ O ₃ .	5.079.		
¹⁴ Alumina. Ruby.	Al ₂ O ₃ .	3.95. Natural.	}	40.°
¹⁵ " "	"	3.7. Artificial.		
¹⁶ " Sapphire.	"	3.98. Natural.		
¹⁷ Ruthenium tetroxide.	Ru O ₄ .			
¹⁸ Magnesia.	Mg O.	3.1932, 0.°	}	
¹⁹ "	"	3.2014, 0.°		
²⁰ "	"	3.2482, 0.°		
²¹ "	"	3.5699, 0.°		
²² Lanthanum oxide.	La ₂ O ₃ .	6.53, 17.°		
²³ Didymium "	Di ₂ O ₃ .	6.852.		
²⁴ Nitrous oxide.	N ₂ O.	0.9004, 0.° L.	-92.°	-99.°
²⁵ Silicon dioxide.	Si O ₂ .	2.61. Quartz.		
²⁶ " "	"	2.247. Assmannite.		

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² Topsoë. C. Cent. 4. 76.	23. 65.	¹⁹ { First sample calcined at
³ Topsoë. C. Cent. 4. 76.	¹² Wernicke. C. S. J. (2). 9.	²⁰ { 350°; second at 440°; third
⁴ Topsoë. C. Cent. 4. 76.	306.	²¹ { at dull redness, last at
⁵ Topsoë. C. Cent. 4. 76.	¹³ Neumann. P. A. 23. 1.	²² Cleve. B. S. C. 21. 196.
⁶ Topsoë. C. Cent. 4. 76.	¹⁴ { Williams. C. N. 28. 101.	²³ Cleve. C. S. J. (2). 13. 340.
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⁸ Topsoë. C. Cent. 4. 76.	¹⁶ { Williams. C. N. 28. 101.	²⁵ Neumann. P. A. 23. 1.
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¹⁰ Topsoë. C. Cent. 4. 76.	80. 458.	

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Silicon dioxide.	Si O ₂	2.311.	Artificial tridymite.	
² " "	"	2.317.		
³ " "	"	2.373.		
⁴ Tin "	Sn O ₂	6.952.	Tinstone.	
⁵ Zirconium "	Zr O ₂	5.42.	Crystallized from borax.	
⁶ " "	"	5.52.		
⁷ Tantalie acid.	Ta ₂ O ₅	7.234-7.253.		
⁸ Lead sulphide.	Pb S.	7.568.	Galena.	
⁹ " "	"	6.77.	Artif. cryst. powder.	
¹⁰ Iron disulphide.	Fe S ₂	5.042.	Pyrite.	
¹¹ " "	"	4.882.	Marcasite.	
¹² Zinc sulphide.	Zn S.	4.060.	Blende.	
¹³ Arsenic disulphide.	As ₂ S ₂	3.240.	Realgar.	
¹⁴ Antimony trisulphide.	Sb ₂ S ₃	4.603.	Stibnite.	
¹⁵ Carbon monosulphide.	C S.	1.66.		
¹⁶ " disulphide.	C S ₂	1.2823, 5°-10°		
¹⁷ " "	"	1.2750, 10°-15°		
¹⁸ " "	"	1.2676, 15°-20°		
¹⁹ " "	"	1.2665, 16°06.		

IV. HYDRATES.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
²⁰ Sulphuric acid.	H ₂ S O ₄	1.857, 0°		
²¹ " "	"	1.85289, 0°		
²² Selenious "	H ₂ Se O ₃	3.123.		
²³ Ferric hydrate.	Fe ₂ O ₃ . 3 H ₂ O.	3.77. Precipitated.		

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and 53.	¹⁶ { Regnault. P. A. 62. 50.	²³ Yorke. P. M. (3). 27.
⁷ Oesten. P. A. 100. 342.	¹⁷ { Regnault. P. A. 62. 50.	269.
⁸ Neumann. P. A. 23. 1.	¹⁸ { Regnault. P. A. 62. 50.	

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Ferric hydrate.	$\text{Fe}_2 \text{O}_3 \cdot \text{H}_2 \text{O}$.	4.22-4.24. Lostwithiel		
² " "	"	4.11. Compact.		
³ " "	"	4.19. Fibrous.		
⁴ Hypophosphorous hydrate.	$\text{H}_3 \text{P O}_2$.	1.493, 18.°8. Fused.		17.°4.
⁵ Phosphorous "	$\text{H}_3 \text{P O}_3$.	1.651, 21.°2. "		70.°1.
⁶ Phosphoric "	$\text{H}_3 \text{P O}_4$.	1.884, 18.°2. "		38.°6.

V. CHLORATES AND BROMATES.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
⁷ Potassium chlorate.	K Cl O_3 .	2.323.		
⁸ Silver "	Ag Cl O_3 .	4.439.		
⁹ Lead "	$\text{Pb Cl}_2 \text{O}_6 \cdot \text{H}_2 \text{O}$.	3.989.		
¹⁰ Mercury oxychlorate.	$\text{Hg}_2 \text{Cl}_2 \text{O}_7 \cdot \text{H}_2 \text{O}$.	5.151.		
¹¹ Potassium bromate.	K Br O_3 .	3.218.		
¹² Calcium "	$\text{Ca Br}_2 \text{O}_6 \cdot \text{H}_2 \text{O}$.	3.329.		
¹³ Strontium "	$\text{Sr Br}_2 \text{O}_6 \cdot \text{H}_2 \text{O}$.	3.773.		
¹⁴ Barium "	$\text{Ba Br}_2 \text{O}_6 \cdot \text{H}_2 \text{O}$.	3.820.		
¹⁵ Lead "	$\text{Pb Br}_2 \text{O}_6 \cdot \text{H}_2 \text{O}$.	4.950.		
¹⁶ Nickel "	$\text{Ni Br}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	2.575.		
¹⁷ Copper "	$\text{Cu Br}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	2.583.		
¹⁸ Magnesium "	$\text{Mg Br}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	2.289.		
¹⁹ Zinc "	$\text{Zn Br}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	2.566.		
²⁰ Cadmium "	$\text{Cd Br}_2 \text{O}_6 \cdot 2 \text{H}_2 \text{O}$.	3.758.		
²¹ Mercury oxybromate.	$\text{Hg}_2 \text{Br}_2 \text{O}_7 \cdot \text{H}_2 \text{O}$.	5.815.		

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VI. DITHIONATES AND SULPHATES.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Lithium dithionate.	$\text{Li}_2 \text{S}_2 \text{O}_6 \cdot 2 \text{H}_2 \text{O}$.	2.158.		
² Sodium "	$\text{Na}_2 \text{S}_2 \text{O}_6 \cdot 2 \text{H}_2 \text{O}$.	2.189.		
³ Potassium "	$\text{K}_2 \text{S}_2 \text{O}_6$.	2.277.		
⁴ Silver "	$\text{Ag}_2 \text{S}_2 \text{O}_6 \cdot 2 \text{H}_2 \text{O}$.	3.605.		
⁵ Ammonium "	$\text{Am}_2 \text{S}_2 \text{O}_6$.	1.704.		
⁶ Calcium "	$\text{Ca S}_2 \text{O}_6 \cdot 4 \text{H}_2 \text{O}$.	2.180.		
⁷ Strontium "	$\text{Sr S}_2 \text{O}_6 \cdot 4 \text{H}_2 \text{O}$.	2.373.		
⁸ Barium "	$\text{Ba S}_2 \text{O}_6 \cdot 4 \text{H}_2 \text{O}$.	3.142.		
⁹ Lead "	$\text{Pb S}_2 \text{O}_6 \cdot 4 \text{H}_2 \text{O}$.	3.245.		
¹⁰ Iron "	$\text{Fe S}_2 \text{O}_6 \cdot 7 \text{H}_2 \text{O}$.	1.875.		
¹¹ Manganese "	$\text{Mn S}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	1.757.		
¹² Cobalt "	$\text{Co S}_2 \text{O}_6 \cdot 8 \text{H}_2 \text{O}$.	1.815.		
¹³ Nickel "	$\text{Ni S}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	1.908.		
¹⁴ Zinc "	$\text{Zn S}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	1.915.		
¹⁵ Cadmium "	$\text{Cd S}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	2.272.		
¹⁶ Magnesium "	$\text{Mg S}_2 \text{O}_6 \cdot 6 \text{H}_2 \text{O}$.	1.666.		
¹⁷ Sodium sulphate.	$\text{Na}_2 \text{S O}_4$.	2.104, 1280.°		
¹⁸ " "	"			1280.°
¹⁹ Potassium "	$\text{K}_2 \text{S O}_4$.	2.676.		
²⁰ Calcium "	Ca S O_4 .	2.955. Anhydrite.		
²¹ Strontium "	Sr S O_4 .	3.955. Celestine.		
²² " "	"	3.949. "		
²³ Barium "	Ba S O_4 .	4.424. Barite.		
²⁴ Lead "	Pb S O_4 .	6.329. Native. }		
²⁵ " "	"	6.212. Precipitated. }		
²⁶ Manganese "	Mn S O_4 .	3.192, 16.°		
²⁷ " "	$\text{Mn S O}_4 \cdot 4 \text{H}_2 \text{O}$.	2.261.		

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SPECIFIC GRAVITY TABLES.

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Manganese sulphate.	Mn S O ₄ . 5 H ₂ O.	2.059, 16.°		
² Iron "	Fe S O ₄ . 7 H ₂ O.	1.9854, 16.°		
³ " "	"	1.851, 15.°5.		
⁴ Nickel "	Ni S O ₄ .	3.643, 16.°		
⁵ " "	Ni S O ₄ . 6 H ₂ O.	2.042-2.074.		
⁶ " "	Ni S O ₄ . 7 H ₂ O.	1.877, 16.°		
⁷ Copper "	Cu S O ₄ .	3.527, 16.°		
⁸ " "	Cu S O ₄ . H ₂ O.	3.125, 16.°		
⁹ " "	Cu S O ₄ . 2 H ₂ O.	2.808, 16.°		
¹⁰ " "	Cu S O ₄ . 3 H ₂ O.	2.268, 16.°		
¹¹ " "	Cu S O ₄ . 5 H ₂ O.	2.268, 16.°		
¹² Zinc "	Zn S O ₄ .	3.435, 16.°		
¹³ " "	Zn S O ₄ . H ₂ O.	3.215, 16.°		
¹⁴ " "	Zn S O ₄ . 7 H ₂ O.	1.976, 15.°5.		
¹⁵ " "	"	1.901, 16.°		
¹⁶ Magnesium "	Mg S O ₄ .	2.675, 16.°		
¹⁷ " "	Mg S O ₄ . H ₂ O.	2.281, 16.°		
¹⁸ " "	Mg S O ₄ . 7 H ₂ O.	1.701, 16.°		
¹⁹ " "	"	1.665, 15.°5.		
²⁰ Glucinum "	Gl S O ₄ . 4 H ₂ O.	1.725.		
²¹ Thorium "	Th (S O ₄) ₂ . 9 H ₂ O.	2.767.		
²² Syngenite.	CaSO ₄ . K ₂ SO ₄ . H ₂ O.	2.603.		
²³ Ferric potassium alum.	FeK(SO ₄) ₂ . 12H ₂ O.	1.831.		
²⁴ " ammonium "	AmK(SO ₄) ₂ . 12H ₂ O.	1.719.		
²⁵ Potassium magnesium sulphate.	K ₂ Mg (S O ₄) ₂ .	2.735,-2.750.		
²⁶ " nickel "	K ₂ Ni (S O ₄) ₂ .	3.086.		
²⁷ " cobalt "	K ₂ Co (S O ₄) ₂ .	3.105.		
²⁸ " manganese "	K ₂ Mn (S O ₄) ₂ .	3.031.		

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Supp.-B.

VII. SELENATES AND CHROMATES.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melting Point.
¹ Lithium selenate.	$\text{Li}_2 \text{Se O}_4 \cdot \text{H}_2 \text{O}$.	2.439.		
² Sodium "	$\text{Na}_2 \text{Se O}_4$.	3.098.		
³ " "	$\text{Na}_2 \text{Se O}_4 \cdot 10 \text{H}_2 \text{O}$.	1.584.		
⁴ Potassium "	$\text{K}_2 \text{Se O}_4$.	3.050.		
⁵ Ammonium "	$\text{Am}_2 \text{Se O}_4$.	2.162.		
⁶ Calcium "	$\text{Ca Se O}_4 \cdot 2 \text{H}_2 \text{O}$.	2.676.		
⁷ Glucinum "	$\text{Gl Se O}_4 \cdot 4 \text{H}_2 \text{O}$.	2.029.		
⁸ Thorium "	$\text{Th (Se O}_4)_2 \cdot 9 \text{H}_2 \text{O}$.	3.026.		
⁹ Manganese "	$\text{Mn Se O}_4 \cdot 2 \text{H}_2 \text{O}$.	2.949.		
¹⁰ " "	$\text{Mn Se O}_4 \cdot 5 \text{H}_2 \text{O}$.	2.334.		
¹¹ Iron "	$\text{Fe Se O}_4 \cdot 7 \text{H}_2 \text{O}$.	2.073.		
¹² Nickel "	$\text{Ni Se O}_4 \cdot 6 \text{H}_2 \text{O}$.	2.314.		
¹³ Cobalt "	$\text{Co Se O}_4 \cdot 5 \text{H}_2 \text{O}$.	2.512.		
¹⁴ " "	$\text{Co Se O}_4 \cdot 6 \text{H}_2 \text{O}$.	2.179.		
¹⁵ " "	$\text{Co Se O}_4 \cdot 7 \text{H}_2 \text{O}$.	2.135.		
¹⁶ Copper "	$\text{Cu Se O}_4 \cdot 5 \text{H}_2 \text{O}$.	2.559.		
¹⁷ Zinc "	$\text{Zn Se O}_4 \cdot 5 \text{H}_2 \text{O}$.	2.591.		
¹⁸ " "	$\text{Zn Se O}_4 \cdot 6 \text{H}_2 \text{O}$.	2.325.		
¹⁹ Magnesium "	$\text{Mg Se O}_4 \cdot 6 \text{H}_2 \text{O}$.	1.928.		
²⁰ Cadmium "	$\text{Cd Se O}_4 \cdot 2 \text{H}_2 \text{O}$.	3.632.		
²¹ Ammonium hydrogen selenate.	Am H Se O_4 .	2.409.		
²² Sodium potassium "	$\text{Na}_2 \text{Se O}_4 \cdot 3 \text{K}_2 \text{Se O}_4$.	3.095.		
²³ Manganese "	$\text{Mn K}_2 (\text{Se O}_4)_2 \cdot 2 \text{H}_2 \text{O}$.	3.070.		
²⁴ " ammonium "	$\text{Mn Am}_2 (\text{Se O}_4)_2 \cdot 6 \text{H}_2 \text{O}$.	2.093.		
²⁵ Iron " "	$\text{Fe Am}_2 (\text{Se O}_4)_2 \cdot 6 \text{H}_2 \text{O}$.	2.160.		
²⁶ Cobalt " "	$\text{Co Am}_2 (\text{Se O}_4)_2 \cdot 6 \text{H}_2 \text{O}$.	2.212.		
²⁷ " potassium "	$\text{Co K}_2 (\text{Se O}_4)_2 \cdot 6 \text{H}_2 \text{O}$.	2.514.		
²⁸ Nickel " "	$\text{Ni K}_2 (\text{Se O}_4)_2 \cdot 6 \text{H}_2 \text{O}$.	2.539.		

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³ Topsoë. C. Cent. 4. 76.	¹² Topsoë. C. Cent. 4. 76.	²² Topsoë. C. Cent. 4. 76.
⁴ Topsoë. C. Cent. 4. 76.	¹³ Topsoë. C. Cent. 4. 76.	²³ Topsoë. C. Cent. 4. 76.
⁵ Topsoë. C. Cent. 4. 76.	¹⁴ Topsoë. C. Cent. 4. 76.	²⁴ Topsoë. C. Cent. 4. 76.
⁶ Topsoë. C. Cent. 4. 76.	¹⁵ Topsoë. C. Cent. 4. 76.	²⁵ Topsoë. C. Cent. 4. 76.
⁷ Topsoë. C. Cent. 4. 76.	¹⁶ Topsoë. C. Cent. 4. 76.	²⁶ Topsoë. C. Cent. 4. 76.
⁸ Topsoë. B. S. C. 21. 121.	¹⁷ Topsoë. C. Cent. 4. 76.	²⁷ Topsoë. C. Cent. 4. 76.
⁹ Topsoë. C. Cent. 4. 76.	¹⁸ Topsoë. C. Cent. 4. 76.	²⁸ Topsoë. C. Cent. 4. 76.
	¹⁹ Topsoë. C. Cent. 4. 76.	

Name.	Formula.	Specific Gravity.	Boil. Point.	Melting Point.
¹ Nickel ammonium selenate.	Ni Am ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.228.		
² Copper " "	Cu Am ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.221.		
³ " potassium " "	Cu K ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.527.		
⁴ Zinc " "	Zn K ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.538.		
⁵ " " " "	Zn K ₂ (Se O ₄) ₂ . 2 H ₂ O.	3.210.		
⁶ " ammonium " "	Zn Am ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.200.		
⁷ Cadmium " "	Cd Am ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.307.		
⁸ " " " "	Cd Am ₂ (Se O ₄) ₂ . 2 H ₂ O.	2.897.		
⁹ Magnesium " "	Mg Am ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.035.		
¹⁰ " potassium " "	Mg K ₂ (Se O ₄) ₂ . 6 H ₂ O.	2.336.		
¹¹ Cadmium " "	Cd K ₂ (Se O ₄) ₂ . 2 H ₂ O.	3.376.		
¹² Silver ammonio " "	Ag ₂ (Se O ₄) ₂ . 4 N H ₃ .	2.854.		
¹³ Potassium chromate.	K ₂ Cr O ₄ .	2.678, 15.°5.		
¹⁴ " trichromate.	K ₂ Cr ₃ O ₁₀ .	2.676. }		
¹⁵ " " "	" "	2.702. }		
¹⁶ Silver chromate.	Ag ₂ Cr O ₄ .	5.536.		
¹⁷ " ammonio chromate.	Ag ₂ Cr O ₄ . 4 N H ₃ .	2.717.		

VIII. NITRATES, VANADATES, ARSENATES, AND PHOSPHATES.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melting Point.
¹⁸ Sodium nitrate.	Na NO ₃ .	2.246, 15.°5.		
¹⁹ " " "	"	2.24-2.25.		
²⁰ " " "	"	1.878, 314.°		
²¹ " " "	"			314.°
²² " " "	Na NO ₃ . 7 H ₂ O.	1.357, 0.°		L. above -15.°

AUTHORITIES.

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³ Topsoë. C. Cent. 4. 76.	¹² Topsoë. C. Cent. 4. 76.	¹⁸ Holker. P. M. (3) 27.
⁴ Topsoë. C. Cent. 4. 76.	¹³ Holker. P. M. (3) 27.	213.
⁵ Topsoë. C. Cent. 4. 76.	213.	¹⁹ Page & Keightley. C. S. J. (2). 10. 506.
⁶ Topsoë. C. Cent. 4. 76.	¹⁴ Schröder. A. C. P. 174.	²⁰ Braun. C. S. J. (2). 13. 31.
⁷ Topsoë. C. Cent. 4. 76.	249.	²¹ Braun. P. A. 154. 190.
⁸ Topsoë. C. Cent. 4. 76.	¹⁵ Schröder. A. C. P. 174.	²² Ditte. B. S. C. 24. 303.
⁹ Topsoë. C. Cent. 4. 76.	249.	

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹ Potassium nitrate.	K N O ₃ .	2.074, 15°.5.		
² " "	"	2.06.		
³ " "	"	1.702, 342.°.		
⁴ " "	"			342.°
⁵ Ammonium "	N H ₄ . N O ₃ .			145.°
⁶ Barium "	Ba N ₂ O ₆ .	3.228, 17°.5.		
⁷ Lead "	Pb N ₂ O ₆ .	4.41, 15°.5.		
⁸ Bismuth vanadate.		5.91, Pucherite.		
⁹ Potassium hydrogen arsenate.	K H ₂ As O ₄ .	2.862.		
¹⁰ Ammonium " "	Am H ₂ As O ₄ .	2.308.		
¹¹ " " phosphate	Am H ₂ P O ₄ .	1.779.		

IX. CARBONATES.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹² Sodium carbonate.	Na ₂ C O ₃ .	2.041, 960.°		
¹³ " "	"			960.°
¹⁴ " "	Na ₂ C O ₃ . 10 H ₂ O.	1.455, 15°.5.		
¹⁵ Potassium "	K ₂ C O ₃ .	2.00, 1150.		
¹⁶ " "	"			1150.°
¹⁷ Arragonite.	Ca C O ₃ .	2.926. }		
¹⁸ Calcite.	"	2.750. }		
¹⁹ Lead carbonate.	Pb C O ₃ .	6.510. }	Native. Two localities.	
²⁰ " "	"	6.717. }		
²¹ Chalybite.	Fe C O ₃ .	3.872.		
²² Magnesite.	Mg C O ₃ .	3.037.		
²³ Dolomite	Ca C O ₃ . Mg C O ₃ .	2.914. }		
²⁴ " "	"	2.918. }		

AUTHORITIES.

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⁴ Braun. P. A. 154. 190.	¹² Braun. C. S. J. (2). 13. 31.	bd. 6. 622.
⁵ Frankenheim. P. A. 93. 17.	¹³ Braun. P. A. 154. 190.	²⁰ { Schröder. P. A. Ergänz.
⁶ Kremers. P. A. 85. 42.	¹⁴ Holker. P. M. (3). 27. 214.	bd. 6. 622.
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		²³ { Neumann. P. A. 23. 1.
		²⁴ { Neumann. P. A. 23. 1.

X. SILICOFLUORIDES.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹ Lithium silicofluoride.	$\text{Li}_2 \text{Si F}_6 \cdot 2\text{H}_2\text{O}$.	2.244.		
² Ammonium "	$\text{Am}_2 \text{Si F}_6$.	1.970.		
³ Calcium "	$\text{Ca Si F}_6 \cdot 2\text{H}_2\text{O}$.	2.254.		
⁴ Copper "	$\text{Cu Si F}_6 \cdot 4\text{H}_2\text{O}$.	2.535.		
⁵ " "	$\text{Cu Si F}_6 \cdot 6\text{H}_2\text{O}$.	2.207.		
⁶ Nickel "	$\text{Ni Si F}_6 \cdot 6\text{H}_2\text{O}$.	2.109.		
⁷ Cobalt "	$\text{Co Si F}_6 \cdot 6\text{H}_2\text{O}$.	2.067.		
⁸ Manganese "	$\text{Mn Si F}_6 \cdot 6\text{H}_2\text{O}$.	1.858.		
⁹ Magnesium "	$\text{Mg Si F}_6 \cdot 6\text{H}_2\text{O}$.	1.761.		
¹⁰ Zinc "	$\text{Zn Si F}_6 \cdot 6\text{H}_2\text{O}$.	2.104.		

XI. MISCELLANEOUS INORGANIC COMPOUNDS.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹¹ Potassium manganicyanide.	$\text{K}_3 \text{Mn Cy}_6$.	1.821.		
¹² Potassium cobalticyanide.	$\text{K}_3 \text{Co Cy}_6$.	1.913.		
¹³ Thorium platinocyanide.	$\text{Th Pt}_2 \text{Cy}_6 \cdot 16\text{H}_2\text{O}$.	2.460.		
¹⁴ Ammonio-cyanide of silver and iron.	$(\text{Fe}, \text{Ag}_6 \text{Cy}_{12} \cdot 3\text{NH}_3)_2 \cdot \text{H}_2\text{O}$.	2.42-2.47. 14°2.		
¹⁵ Ammonium ferrocyanide with ammonium chloride.	$\text{Am}_4 \text{FeCy}_6 \cdot 2\text{AmCl} \cdot 3\text{H}_2\text{O}$.	1.490.		
¹⁶ Potassium selenate with nickel sulphate.	$\text{K}_2 \text{Ni} (\text{SeO}_4) (\text{SO}_4) \cdot 6\text{H}_2\text{O}$.	2.34.		

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³ Topsoë. C. Cent. 4.76.	⁹ Topsoë. C. Cent. 4.76.	¹⁵ Topsoë. C. Cent. 4.76.
⁴ Topsoë. C. Cent. 4.76.	¹⁰ Topsoë. C. Cent. 4.76.	¹⁶ Von Gerichten. B. S. C. 20. 80.
⁵ Topsoë. C. Cent. 4.76.	¹¹ Topsoë. C. Cent. 4.76.	
⁶ Topsoë. C. Cent. 4.76.	¹² Topsoë. C. Cent. 4.76.	

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹ Magnesium niobate.	4 Mg O. Nb ₂ O ₅ .	4.3.		
² Manganese "		4.94.		
³ Cryst. tin compound.	2 Sn O ₂ . P ₂ O ₅ .	3.87-3.98.		
⁴ " " "	Sn O ₂ . P ₂ O ₅ .	3.61.		
⁵ " zirconium "	Zr O ₂ . P ₂ O ₅ .	3.12-3.14.		
⁶ Vanadium-wagnerite.	Ca ₃ V ₂ O ₈ . Ca Cl ₂ .	4.01. Artif. cryst.		
⁷ Iron nitride.	Fe ₃ N ₂ .	3.147. Impure.		
⁸ Palladium hydride.	Pd ₂ H.	11.06.		
⁹ Sodium "	Na ₂ H.	0.959.		

XII. METALLIC ALLOYS.

Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹⁰ Silver and copper.	Ag ₃ Cu ₂ .	9.0554. Molten.		
¹¹ Lead and palladium.	Pb Pd ₃ .	11.225.		
¹² " " tin.	Pb Sn.	9.387. 13°.3.		
¹³ " " "	Pb Sn ₂ .	8.777. 13°.3.		
¹⁴ " " mercury.	Pb ₂ Hg ₃ .	12.49. 17°.		
¹⁵ Tin and bismuth.	Sn ₂ Bi.	8.085.		
¹⁶ " " "	Sn Bi.	8.759.		
¹⁷ Zinc and antimony.	Sb Zn.	6.383-6.384.		
¹⁸ " " "	Sb ₂ Zn ₃ .	6.327.		
¹⁹ Tin, bismuth and lead.	Pb Sn ₂ Bi.	9.194. 11°.		
²⁰ " " " "	Pb Sn ₂ Bi ₂ .	9.253. 20°.		
²¹ " " " anti- mony	Bi Sb Sn ₂ .	7.883. 20°.		

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² Joly. B. S. C. 25. 67.	⁹ Troost & Hautefeuille. C. R. 78. 970.	¹⁵ Regnault. P. A. 53. 67.
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⁴ Knop. A. C. P. 159. 39.	¹¹ Bauer. 24. 317.	¹⁷ Cooke. P. M. (4). 19. 413.
⁵ Knop. A. C. P. 159. 48.	¹² Regnault. P. A. 53. 67.	¹⁸ Cooke. P. M. (4). 19. 413.
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		²¹ Regnault. P. A. 53. 67.

XIII. HYDROCARBONS.

Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Amyl hydride.	C ₅ H ₁₂ .	.626. 14°.	32°-35°.	
² Hexyl "	C ₆ H ₁₄ .	.667. 13°.	68°-70°.	
³ Heptyl "	C ₇ H ₁₆ .	.693. 12°.	96°-98°.	
⁴ Octyl "	C ₈ H ₁₈ .	.723. 13°.	118°-120°.	
⁵ Nonyl "	C ₉ H ₂₀ .	.744. 13°.	138°-140°.	
⁶ Decatyl "	C ₁₀ H ₂₂ .	.758. 14°.	158°-160°.	
⁷ Endecatyl "	C ₁₁ H ₂₄ .	.770. 14°.	176°-178°.	
⁸ Duodecatyl "	C ₁₂ H ₂₆ .	.784. 14°.	a. 200°.	
⁹ Heptylene.	C ₇ H ₁₄ .	.9212. 24°.		
¹⁰ "	"	.7144. 0°.	83°-84°.	
¹¹ Benzol.	C ₆ H ₆ .	.899487. 0°.		
¹² "	"	.883573. 15°.		
¹³ "	"	.872627. 25°.		
¹⁴ "	"	.846170. 50°.		
¹⁵ "	"	.818721. 75°.		
¹⁶ "	"	.8931. 5°-10°.		
¹⁷ "	"	.8827. 10°-15°.		
¹⁸ "	"	.8838. 15°-20°.		

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		¹⁸ Regnault. P. A. 62. 50.

Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Benzol.	$C_6 H_6$.	.90023. 0°.	}	
² "	"	.89502. 5°.		
³ "	"	.88982. 10°.		
⁴ "	"	.88462. 15°.		
⁵ "	"	.87940. 20°.		
⁶ "	"	.87417. 25°.		
⁷ "	"	.86891. 30°.		
⁸ "	"	.86362. 35°.		
⁹ "	"	.85829. 40°.		
¹⁰ "	"	.85291. 45°.		
¹¹ "	"	.84748. 50°.		
¹² "	"	.84198. 55°.		
¹³ "	"	.83642. 60°.		
¹⁴ "	"	.83078. 65°.		
¹⁵ "	"	.82505. 70°.		
¹⁶ "	"	.81923. 75°.		
¹⁷ "	"	.81331. 80°.		
¹⁸ Toluol.	$C_7 H_8$.	.866. 20°.	}	
¹⁹ Cumol.	$C_9 H_{12}$.	.87976. 0°.		
²⁰ "	"	.85870. 25°.		
²¹ "	"	.83756. 50°.		
²² "	"	.81585. 75°.		
²³ "	"	.79324. 100°.		
²⁴ Meta ethyl toluol.	"	.869. 20°.		158°-159°.
²⁵ Cymol. From cummin oil.	$C_{10} H_{14}$.	.87446. 0°.	}	175° I.
²⁶ " "	"	.85457. 25°.		

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¹ Adrieenz. B. D. C. G. 6. 442.	¹⁰ Adrieenz. B. D. C. G. 6. 442.	¹⁹ Pisati & Paterno. C. S. J. (2). 12. 686.
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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Cymol. From cummin oil.	$C_{10}H_{16}$.82352. 20°.	175°.1.	—
² " "	"	.81409. 75°.		
³ " "	"	.79307. 100°.		
⁴ " "	"	.8708. 0°.	175°.	
⁵ " "	"	.8572. 20°.2.		
⁶ " From cymyl alcohol.	"	.87227. 0°.		
⁷ " "	"	.85258. 25°.	177°.25.	
⁸ " "	"	.82352. 50°.		
⁹ " "	"	.81209. 75°.		
¹⁰ " "	"	.79129. 100°.	176°.55.	
¹¹ " From camphor.	"	.87224. 0°.		
¹² " "	"	.85237. 25°.		
¹³ " "	"	.83251. 50°.	175°.	
¹⁴ " "	"	.81230. 75°.		
¹⁵ " "	"	.79122. 100°.		
¹⁶ " "	"	.8732. 0°.	175°.	
¹⁷ " From wormwood oil.	"	.8707. 0°.		
¹⁸ " From thyme oil.	"	.86542. 0°.		
¹⁹ " "	"	.78429. 100°.	180°-182°.	
²⁰ " "	"	.86.		
²¹ " "	"	.8424. { m. of 8 from dif- ferent sources.		
²² " "	"	.8638.	180°-182°.	
²³ " "	"	.858. 16°.		
²⁴ Dimethyl ethyl benzol.	"	.8644. 20°.		

AUTHORITIES.

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² Pisati & Paterno. C. S. J. (2). 12. 686.	¹⁰ Pisati & Paterno. C. S. J. (2). 12. 686.	¹⁸ Pisati & Paterno. C. S. J. (2). 12. 686.
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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Tetramethyl benzol.	C ₁₀ H ₁₄ .	.8816. 9°.	196°.	
² Normal phenyl butyl.	"	.8622. 16°.	180°.	
³ α Phenyl isobutyl.	"	.89. 15°.	167°.5.	
⁴ β " "	"	.8726. 16°.	170°-172°.	
⁵ Methyl diethyl benzol.	C ₁₁ H ₁₆ .	.8790. 20°.	198°-200°.	
⁶ Oil of citron.	C ₁₀ H ₁₆ .	.8597. 5°-10°.		
⁷ " "	"	.8558. 10°-15°.		
⁸ " "	"	.8518. 15°-20°.		
⁹ Caoutchin.	"	.855. 0°.		
¹⁰ " "	"	.842. 20°.	177°-179°.	
¹¹ Polymer of isoprene.	"	.866. 0°.		
¹² " "	"	.854. 21°.	176°-181°.	
¹³ Olibene.	"	.863. 12°.	156°-158°.	
¹⁴ Calamus oil.	"	.8793. 0°.	158°-159°.	
¹⁵ From parsnip oil.	"	.865. 12°.	160°-164°.	
¹⁶ Camphene.	"	.8481. 47°.7.		
¹⁷ " "	"	.8387. 58°.9.		
¹⁸ " "	"	.8211. 79°.7.	156°-157°.	45°-47°.
¹⁹ " "	"	.8062. 97°.7.		
²⁰ Terebene.	"	.8645. 5°-10°.		
²¹ " "	"	.8605. 10°-15°.		
²² " "	"	.8564. 15°-20°.		
²³ " "	"	.8767. 0°.		
²⁴ " "	"	.8600. 20°.		
²⁵ " "	"	.8433. 40°.	156°.	
²⁶ " "	"	.8267. 60°.		
²⁷ " "	"	.8100. 80°.		
²⁸ " "	"	.7933. 100°.		
²⁹ " "	"	.8264. 15°.	155°-157°.	

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SPECIFIC GRAVITY TABLES.

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Terebenthene.	C ₁₀ H ₁₆ .	.8767. 0°.	156°-5.	
² " "	"	.8601. 20°.		
³ " "	"	.8436. 40°.		
⁴ " "	"	.8270. 60°.		
⁵ " "	"	.8105. 80°.		
⁶ " "	"	.7939. 100°.		
⁷ Isoterebenthene.	"	.8586. 0°.	175°.	
⁸ " "	"	.8427. 20°.28.		
⁹ " "	"	.8273. 40°.19.		
¹⁰ " "	"	.8131. 58°.32.		
¹¹ " "	"	.7964. 79°.24.		
¹² " "	"	.7793. 100°.		
¹³ From cubeb oil.	C ₁₅ H ₂₄ .	.9289. 0°.	264°-265°.	Below 100°.
¹⁴ " clove. "	"	.905. 15°.	253°.9.	
¹⁵ " calamus "	"	.942. 0°.	255°-258°.	
¹⁶ Oil of cedar.	"	.9231. 18°.	252°.	
¹⁷ " santal wood.	"	.9190.	255°.	
¹⁸ " vitivert.	"	.9332.		
¹⁹ Petrolene.	"	.8953. 5°-10°.		
²⁰ " "	"	.8921. 10°-15°.		
²¹ " "	"	.8888. 15°-20°.	260°.	
²² Poplar oil.	C ₂₀ H ₃₂ .	.9002.		
²³ Tetraterebenthene.	C ₄₀ H ₆₄ .	.977. 0°.		
²⁴ Isopropyl acetylene.	C ₆ H ₈ .	.652. 11°.	85°.	—2.
²⁵ Dipropargyl.	C ₆ H ₆ .	.81. 18°.		
²⁶ Hexhydroisoxylol.	C ₈ H ₁₆ .	.777. 0°.		
²⁷ Tetramethyl allene.	C ₇ H ₁₂ .	.9513. 9°.	118°-120°.	
²⁸ Tollyl phenyl.	C ₁₃ H ₁₂ .	1.015. 27°.	263°-267°.	
²⁹ Benzyl ethyl benzol.	C ₁₅ H ₁₆ .	.985. 18°.9.	294°-295°.	
³⁰ Phenanthrene tetrahy- dride.	C ₁₄ H ₁₄ .	1.067. 10°.2.	310°.	

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Phenyl xylene.	C ₁₄ H ₁₄ .	1.01. 0°.	283°-286°.	
² From benzyl toluol.	C ₂₁ H ₂₀ .	1.049.	392°-396°.	
³ " phenylbromethyl.	C ₁₅ H ₁₆ .	.98.	278°-280°.	
⁴ " calamus oil.	C ₁₀ H ₁₈ .	.8793. 0°.	158°-159°.	
⁵ Retene.	C ₁₈ H ₁₈ .	1.08-1.13.		98°.5.

XIV. COMPOUNDS CONTAINING C, H, AND O.

Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
⁶ Methyl alcohol.	C H ₄ O.	.7997. 15°.		
⁷ Ethyl " "	C ₂ H ₆ O.	.815. 0°.		
⁸ " " "	"	.80214. 15°.		
⁹ " " "	"	.8150. 5°-10°.		
¹⁰ " " "	"	.8113. 10°-15°.		
¹¹ " " "	"	.8072. 15°-20°.		
¹² " " "	"	.7946. 16°.03.		
¹³ Propyl " "	C ₃ H ₈ O.	.8198. 0°.		
¹⁴ " " "	"	.80825. 15°.		
¹⁵ Butyl " "	C ₄ H ₁₀ O.	.806. 15°.		
¹⁶ Amyl " "	C ₅ H ₁₂ O.	.8253. 0°.		
¹⁷ " " "	"	.8146. 15°.		
¹⁸ " " "	"	.8255. 0°.	130°.	
¹⁹ " " "	"	.808. 15°.	128°.	
²⁰ Diethyl carbinol.	"	.832. 0°.		
²¹ " " "	"	.819. 16°.	.116°-117°.	

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Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
¹ Diethyl carbinol.	$C_5 H_{12} O.$.831. 0°.	116°.5.	
² " "	"	.816. 18°.		
³ Amylene hydrate.	"	.827. 0°.	118°.5.	
⁴ " "	"	.815. 18°.		
⁵ " "	"	.827. 17°.	108°.	
⁶ Alcohol from amylene.	"	.8258. 0°.	103°-104°.	
⁷ " " "	"	.810. 19°.		
⁸ Ethyl allyl hydrate.	"	.826. 0°.	134°.	
⁹ " " "	"	.815. 18°.		
¹⁰ Isohexyl alcohol.	$C_8 H_{18} O.$	.83433. 0°.	134°.5-135°.5.	
¹¹ " "	"	.81825. 20°.		
¹² Ethyl propyl carbinol.	"	.8335. 0°.	175°.5-177°.5.	
¹³ " " "	"	.8188. 20°.		
¹⁴ Heptyl alcohol.	$C_7 H_{16} O.$	.8323. 17°.	131°-132°.	
¹⁵ " "	"	.823. 16°.	181°-182°.	
¹⁶ Methyl hexyl carbinol.	$C_8 H_{18} O.$		179°.5.	
¹⁷ " " "	"			
¹⁸ Ethyl oxide.	$C_4 H_{10} O.$	.7297. 5°-10.	131°.1.	
¹⁹ " "	"	.7241. 10°-15°.		
²⁰ " "	"	.7185. 15°-20°.		
²¹ Ethyl hexyl oxide.	$C_8 H_{18} O.$.7865. 0°.	120°-121°.	
²² " " "	"	.7702. 20°.		
²³ " " "	"	.7574. 40°.		
²⁴ Secondary butyl oxide.	"	.756. 21°.		

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Acetic acid.	$C_2 H_4 O_2$.	1.0647. 5°-10°.	173°.	35°3-35°5.
² " "	"	1.0591. 10°-15°.		
³ " "	"	1.0535. 15°-20°.		
⁴ Valeric "	$C_5 H_{10} O_2$.	.917. 15°.		
⁵ Trimethylacetic acid.	"	.944. 0°.		
⁶ " "	"	.905. 50°.	163°7-163°8.	35°3-35°5.
⁷ Caproic "	$C_6 H_{12} O_2$.	.9438. 0°.		
⁸ " "	"	.928. 20°.		
⁹ " "	"	.9164. 40°.	205°.	s.—10°.
¹⁰ Oenanthic "	$C_7 H_{14} O_2$.	.9345. 0°.		
¹¹ " "	"	.9278. 8° 5.		
¹² " "	"	.9208. 16°.	223°-224°.	s.—10°.
¹³ " "	"	.9110. 28°.		
¹⁴ " "	"	.9359. 0°.		
¹⁵ " "	"	.9348. 9°.	244°-246°.	
¹⁶ " "	"	.9235. 28°.		
¹⁷ Isononylic "	$C_9 H_{18} O_2$.	.90325. 18°.		
¹⁸ Propionic anhydride.	$C_6 H_{10} O_3$.	1.0169. 15°.	168°-169°.	
¹⁹ Methyl formate.	$C_2 H_4 O_2$.	.9928. 0°.	30° 4.	
²⁰ " acetate.	$C_3 H_6 O_2$.	.940. 0°.	56°-58°.	
²¹ Acetate from amylene.	$C_7 H_{14} O_2$.	.8909. 0°.	124°-124° 5.	
²² " " "	"	.8738. 19°.		
²³ " " diethyl-carbinol.	"	.909. 0°.	132°.	
²⁴ " " "	"	.893. 16°.		
²⁵ Isohexyl acetate.	$C_8 H_{16} O_2$.		149°-151°.	

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Ethyl trimethylacetate	$C_7 H_{14} O_2$.875. 0°.	118°5.	
² " caproate.	$C_8 H_{16} O_2$	.8898. 0°.	166°9-167°3.	
³ " "	"	.8728. 20°.		
⁴ " "	"	.8596. 40°.		
⁵ " œnanthate.	$C_9 H_{18} O_2$	.8735. 16°.	180°-187°.	
⁶ " isononylate.	$C_{11} H_{22} O_2$	.86406. 17°.	213°-215°.	
⁷ Aldehyde.	$C_3 H_4 O$	.8217. 5°-10°.		
⁸ " "	"	.8173. 10°-15°.		
⁹ " "	"	.8130. 15°-20°.		
¹⁰ Acetone.	$C_3 H_6 O$	.7998. 15°.	53°3-56°6.	
¹¹ Diethyl ketone.	$C_5 H_{10} O$	.829. 0°.	104°.	
¹² " "	"	.811. 19°.		
¹³ Ketone from amylene.	"	.828. 0°.	103°.	
¹⁴ " " "	"	.810. 19°.		
¹⁵ Methyl isopropyl ketone.	"	.811. 15°.	93°-94°.	
¹⁶ Ethyl propyl "	$C_6 H_{12} O$	.833. 0°.	122°-124°.	
¹⁷ Di isopropyl "	$C_7 H_{14} O$	.8254. 17°.	124°-126°.	
¹⁸ Butyrone.	"	.82. 20°.	144°.	
¹⁹ Propylene glycol.	$C_3 H_8 O_2$	1.053. 19°.	216°.	
²⁰ Butylene "	$C_4 H_{10} O_2$	1.0189. 0°.	191°-192.	
²¹ " "	"	1.0059. 17°5.		
²² Amylene "	$C_5 H_{12} O_2$.9945. 0°.	187°5.	
²³ " "	"	.9800. 19°.		

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Amylene glycol.	$C_6 H_{12} O_2$.9987. 0°.	206°.	
² " "	"	.9843. 21° 5.		
³ Ethylidene diacetate.	$C_6 H_{10} O_4$	1.060. 12°.	165°-168°.	38°. 3° 5.
⁴ Propylene "	$C_7 H_{12} O_4$	1.070. 19°.	209°-210°.	
⁵ Propyl carbonate.	$C_7 H_{14} O_3$	.968. 22°.	156°-160°.
⁶ Ethyl oxalate.	$C_6 H_{10} O_4$	1.1010. 5°-10°.		
⁷ " "	"	1.0953. 10°-15°.		
⁸ " "	"	1.0898. 15°-20°.		
⁹ Propyl "	$C_6 H_{14} O_4$	1.018. 22°.	209°-211°.	
¹⁰ Butyl "	$C_{10} H_{18} O_4$	1.002. 14°.		
¹¹ Methyl sebate.	$C_{12} H_{22} O_4$		287°.	
¹² Ethyl "	$C_{14} H_{26} O_4$		307°.	
¹³ Amyl "	$C_{20} H_{38} O_4$	.951. 18°.	366°.
¹⁴ Ethyl tetramethylsuccinate.		1.012. 0°.	230°-231°.	
¹⁵ " "		1.0015. 13° 5.		
¹⁶ " acetosuccinate.	$C_{10} H_{16} O_5$	1.079. 21°.	260°-263°.	
¹⁷ " acetomalonate.	$C_9 H_{14} O_5$	1.080. 23°.	238°-240°.	
¹⁸ Methyl malonate.	$C_6 H_8 O_4$	1.135. 22°.	175°-180°.	
¹⁹ Ethyl acrylate.	$C_5 H_8 O_2$	.9252. 0°.	101°-102°.
²⁰ " "	"	.9136. 15°.		
²¹ " glycerate.	$C_5 H_{10} O_4$	1.193. 6°.	230°-240°.	
²² " allylacetate.	$C_9 H_{14} O_5$.982. 20°.		
²³ " glycollate.	$C_4 H_8 O_3$	1.0333.	150°.	

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.	
¹ Ethyl pivalate.*	C ₇ H ₁₄ O ₂ .	.8773. 0°.	118°.5.	5°-6°.	
² " "	"	.8535. 25°.			
³ " diallyloxalate.	C ₁₀ H ₁₆ O ₃ .	.9873. 0°.			
⁴ " "	"	.9718. 18°.	213°.6.		
⁵ Pyroterebic acid.	C ₈ H ₁₀ O ₂ .	1.006. 26°.			207°.
⁶ Acid from petroleum.	C ₁₁ H ₂₀ O ₂ .	.982. 0°.			258°-261°.
⁷ " " "	"	.969. 23°.	236°-240°.		
⁸ Ether of above acid.	C ₁₃ H ₂₄ O ₂ .	.939. 0°.				238°-240°.
⁹ " " " "	"	.919. 27°.			
¹⁰ Propyl salicylate.	C ₁₀ H ₁₂ O ₃ .	1.021. 21°.			
¹¹ Glycerin.	C ₃ H ₈ O ₃ .	1.2609.	290°.08.	15°.5.	
¹² " "	"	"			
¹³ " cryst.	"	1.261. 15°.5.			
¹⁴ Glycerin ether.	C ₈ H ₁₀ O ₃ .	1.0907. 18°.	170°-172°.		
¹⁵ " "	"	1.16 16°.			
¹⁶ Cane sugar.	C ₁₂ H ₂₂ O ₁₁ .	1.5951. 15°.			
¹⁷ " "	"	1.63.	250°-253°.		
¹⁸ Aldol.	C ₄ H ₈ O ₂ .	1.1208. 0°.			
¹⁹ " "	"	1.1094. 16°.			
²⁰ " "	"	1.0819. 49°.6.			
²¹ Dibutylated ethyl acetate.	C ₁₄ H ₂₆ O ₃ .	.947. 10.	250°-253°.		
²² Derivative of amyl aldehyde.	C ₁₀ H ₁₈ O ₂ .	.861. 0°.	187°-191°.		
²³ " "	"	.851. 14°.			

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	¹⁵ Zotta. A. C. P. 174. 87.	²³ Göss & Hell. B. D. C. G. 8. 372.

* Compare with Ethyl Trimethylacetate.

Supp.-C.

Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.	
¹ Pinacolin. Synthetic.	C ₆ H ₁₂ O.	.830. 0°.	106°.		
² " " "	"	.791. 50°.			
³ " From acetone.	"	.823. 0°.			
⁴ " " "	"	.787. 50°.			
⁵ Methyl amyl pinacolin	C ₇ H ₁₄ O.	.842. 0°.	131°-132°.5		
⁶ " " "	"	.825. 21°.			
⁷ Butyl ethyl	"	.831. 0°.	125°.5-126°.		
⁸ " " "	"	.810. 21°.			
⁹ Ethyl amyl	C ₈ H ₁₆ O.	.845. 0°.	150°.5-151°.5		
¹⁰ " " "	"	.829. 21°.			
¹¹ Pinacolic alcohol.	C ₆ H ₁₄ O.	.8347. 0°.	120°.5.		
¹² Diacetone "	C ₆ H ₁₂ O ₂ .	.9306. 25°.	163°.5-164°.5	204°.	
¹³ Propargyl acetate.	C ₅ H ₆ O ₂ .	1.0031. 12°.	124°-125°.		
¹⁴ Phenylethyl "	C ₁₀ H ₁₂ O ₂ .	1.05. 17°.	213°-216°.		
¹⁵ Phenylacetone.	C ₉ H ₁₀ O.	1.010. 3°.	215°.		
¹⁶ Phenyl propyl alcohol.	C ₉ H ₁₂ O.	1.008. 18°.	235°.		
¹⁷ " " ketone.	C ₁₀ H ₁₂ O.	.990. 15°.	220°-222°.		
¹⁸ " " "	"	.992. 15°.	218°-221°.		
¹⁹ Propyl phenate.	C ₉ H ₁₂ O.	.968. 20°.	190°-191°.		
²⁰ Acetophenone alcohol	—	1.013.	202°-203°.		
²¹ Benzyl phenylacetate.	C ₁₅ H ₁₄ O ₂ .	1.101.	317°-319°.		
²² Ngai camphor.	C ₁₀ H ₁₆ O.	1.02.			
²³ Anethol.	C ₁₀ H ₁₂ O.	.984. 20°.			
²⁴ Acetocinnamone.	C ₁₀ H ₁₀ O.	1.008.	240°-241°.		
²⁵ Phloryl ethyl ether.	C ₁₀ H ₁₄ O.	.9323. 18°.	215°-217°.		
²⁶ Phenol.	C ₆ H ₆ O.	1.0709. 38°.		36°.	
²⁷ "	"	1.066. Cryst.	180°-180°.5.	40°-41°.	

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⁴ Butlerow. A. C. P. 174. 127.	¹² Heintz. A. C. P. 178. 349.	²¹ Slawik. C. S. J. (2). 13. 59.
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⁷ { Wichnegradsky. B. D. C. G. 8. 541.	¹⁵ Radsisewski. B. D. C. G. 3. 199.	²⁴ Engler & Leist. B. S. C. 20. 204.
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		²⁷ Hamberg. B. D. C. G. 4. 751.

Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Phenol.	C_6H_6O .	1.05433. 40°.	182°.1.	38°-40°.
² " "	"	1.04663. 50°.		
³ " "	"	1.03804. 60°.		
⁴ " "	"	1.02890. 70°.		
⁵ " "	"	1.01950. 80°.		
⁶ " "	"	1.01015. 90°.		
⁷ " "	"	1.00116. 100°.		
⁸ " From tar.	"	1.0558. 46°.		
⁹ " " "	"	1.0463. 56°.		
¹⁰ " From para-oxybenzoic acid.	"	1.0567. 46°.	182°.1.	38°-40°.
¹¹ " " "	"	1.0470. 56°.	182°.1.	39°.
¹² " From salicylic acid.	"	1.0560. 46°.		
¹³ " " "	"	1.0467. 56°.		
¹⁴ " From oxybenzoic acid.	"	1.0559. 46°.		
¹⁵ " " "	"	1.0476. 56°.	182°.3-182°.5	39°.5.
¹⁶ Eugenol.	$C_{10}H_{12}O_2$.	1.066. 15°.	251°.8.	
¹⁷ Methyl eugenol.	$C_{11}H_{14}O_2$.	1.046. 15°.	262°.5.	
¹⁸ Ethyl " "	$C_{12}H_{16}O_2$.	1.026. 0°.	252°-254°.	
¹⁹ " " "	"	1.0117. 18°.5.		
²⁰ Carvol.	$C_{10}H_{14}O$.	.9530. 20°.	227°.	
²¹ Dill carvol.	"	.9562. 20°.		
²² Thymol.	"	1.009136. 0°.	244°.7.	
²³ " "	"	.92424. 100°.		

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Name.	Formula.	Specific Gravity	Boiling Point.	Melting Point.
¹ Cymothymol.	$C_{10}H_{14}O$.	1.01068. 0°.	245°.8.	
² Methyl thymol.	$C_{11}H_{16}O$.	.953898. 0°.		
³ " "	"	.869281. 100°.	216°.7.	
⁴ " "	"	.954314. 0°.		
⁵ " "	"	.870459. 100°.	216°.8.	
⁶ Acetyl "	$C_{12}H_{16}O_2$.	1.009. 0°.	From natural thymol } 244°.7.	
⁷ " "	"	.924. 100°.		
⁸ " "	"	1.010. 0°.	From cymo-thymol } 245°.8.	
⁹ Menthol. } Two	$C_{10}H_{14}O$.	.9515. 20°.	225°.	
¹⁰ " } specimens.	"	.9394. 20°.	225°.	
¹¹ Myristicol.	"	.9466. 20°.	224°.	
¹² Citronellol } Two	$C_{10}H_{16}O$.	.8742. 20°.	200°.	
¹³ " } specimens.	"	.875. 20°.	200°.	
¹⁴ Absinthol.	"	.9267. 20°.	217°.	
¹⁵ Oil of Melaleuca erici- folia.	$C_{10}H_{18}O$.	.8960. 20°.	173°.	
¹⁶ " " " linari- folia.	"	.8985. 20°.	173°.	
¹⁷ " " Eucalyptus oleosa.	"	.9075. 20°.	171°-176°.	
¹⁸ Cajeputol.	"	.9160. 20°.	174°.	
¹⁹ Furfurol.	$C_5H_4O_2$.	1.006. 27°.	168°.	
²⁰ Cholesterine.	$C_{26}H_{44}O$.	1.046-1.047. 20°.		

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C. G. 8. 71.	638.	10. 1.
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C. G. 8. 71.	10. 1.	10. 1.
³ { Pisati & Paterno. B. D.	¹⁰ { Gladstone. C. S. J. (2).	¹⁷ Gladstone. C. S. J. (2).
C. G. 8. 71.	10. 1.	10. 1.
⁴ { Pisati & Paterno. B. D.	¹¹ Gladstone. C. S. J. (2).	¹⁸ Gladstone. C. S. J. (2).
C. G. 8. 71.	10. 1.	10. 1.
⁵ { Pisati & Paterno. B. D.	¹² { Gladstone. C. S. J. (2).	¹⁹ Stenhouse. P. M. (3). 18.
C. G. 8. 71.	10. 1.	124.
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638.	10. 1.	247.
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638.	10. 1.	

XV. COMPOUNDS CONTAINING C. H. AND N.

Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
¹ Hexylamine.	$C_6 H_{15} N.$	.7638.	116°.	
² Propylene diamine.	$C_3 H_{10} N_2.$	.878. 15°.	119°-120°.	
³ Meta toluidine.	$C_7 H_9 N.$	.998. 25°.	197°.	
⁴ Methyl aniline.	"	.976. 15°.	190°-191°.	
⁵ Meta ethyltoluidine.	$C_9 H_{13} N.$	.869. 20°.	158°-159°.	
⁶ Phenylacetic nitrile.	$C_8 H_7 N.$	1.0155. 8°.	229°.	
⁷ From oil of tropaeolum majus.	$C_8 H_7 N.$	1.0146. 18°.	231°-9.	
⁸ Nasturtium oil.	$C_9 H_9 N.$	1.0014. 18°.	261°.	

XVI. COMPOUNDS CONTAINING C. H. N. AND O.

Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
⁹ Propyl nitrite.	$C_3 H_7 N O_2.$	.935. 21°.		
¹⁰ Amyl "	$C_5 H_{11} N O_2.$	.902-.9026.		
¹¹ Nitromethane.	$C H_3 N O_2.$		99°.	
¹² Nitroethane.	$C_2 H_5 N O_2.$	1.0582. 13°.	111°-113°.	
¹³ Nitropropane.	$C_3 H_7 N O_2.$		125°-127°.	
¹⁴ Dinitroethane.	$C_2 H_4 N_2 O_4.$	1.3503. 23°-5.	185°-186°.	
¹⁵ αDinitropropane.	$C_3 H_6 N_2 O_4.$	1.258. 22°-5.	189°.	
¹⁶ Nitrosonitric glycol.	$C_3 H_4 N_2 O_5.$	1.472.		
¹⁷ Nitroglycerine.	$C_3 H_5 N_3 O_9.$	1.6. 15°.		8.-4°.

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⁴ Hofmann. B. D. C. G. 7. 526.	⁹ Cahours. Les Mondes. 32. 280.	¹⁴ E. ter Meer. B. D. C. G. 8. 1080.
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		¹⁷ Kern. C. N. 31. 153.

Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
¹ Nitrobenzol.	$C_6H_5NO_2$	1.2159. 5°-10°.	280°. 134°-135°.	265°. 51°. 88°. 118°. 64°.
² " "	"	1.2107. 10°-15°.		
³ " "	"	1.2504. 15°-20°.		
⁴ Mononitrocymol.	$C_{10}H_{13}NO_2$	1.0385. 18°.		
⁵ Dinitrocymol.	$C_{10}H_{12}N_2O_4$	1.206. 18°.		
⁶ " "	"	1.204. 21°.		
⁷ Metanitrobenzoic acid.	$C_7H_5NO_4$	1.4721.		
⁸ Orthonitrobenzoic "	"	1.5588.		
⁹ Paranitrobenzoic "	"	1.5804.		
¹⁰ Methyl orthonitrophe- nate.	$C_7H_7NO_3$	1.268. 20°.		
¹¹ " paranitrophe- nate.	"	1.233. 20°.	280°. 134°-135°.	265°. 51°. 88°. 118°. 64°.
¹² " adinitrophenate	$C_7H_6N_2O_5$	1.341. 20°.		
¹³ " β "	"	1.319. 20°.		
¹⁴ " trinitrophenate	$C_7H_5N_3O_7$	1.408. 20°.		
¹⁵ Oxetheniline.	$C_8H_{11}NO$	1.11. 0°.		
¹⁶ Ethylglycollic nitrile.	C_4H_7NO	.918. 6°.		
¹⁷ Hydroxycaprylonitrile	$C_8H_{15}NO$	.9048. 17°.	
¹⁸ Leucine.	$C_6H_{13}NO_2$	1.293. 18°.		
¹⁹ Cyanuric acid.	$C_3N_3H_3O_3$	1.768. 0°.		
²⁰ " "	"	2.500. 19°.		
²¹ " "	"	2.228. 24°.	.	
²² " "	"	1.725. 48°.		
²³ Cyamelide.	$(CNHO)_n$	1.974. 0°.		
²⁴ " "	"	1.774. 24°.		

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XVII. METALLIC SALTS OF ORGANIC ACIDS.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹ Sodium triacetate.	$\text{Na C}_6\text{H}_{11}\text{O}_6$.	1.47.		112°.
² Potassium "	$\text{K C}_6\text{H}_{11}\text{O}_6$.	1.34.		127°.
³ Ammonium tartar emetic.	$(\text{Am}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6)_2 \cdot \text{H}_2\text{O}$.	2.324.		
⁴ Calcium formate.	$\text{Ca C}_2\text{H}_2\text{O}_4$.	2.021. Powder.		
⁵ Strontium. "	$\text{Sr C}_2\text{H}_2\text{O}_4 \cdot 2 \text{H}_2\text{O}$.	2.266. "		
⁶ " "	"	2.252. Crystals.		
⁷ Barium "	$\text{Ba C}_2\text{H}_2\text{O}_4$.	3.193. "		
⁸ " "	"	3.219. Powder.		
⁹ Lead "	$\text{Pb C}_2\text{H}_2\text{O}_4$.	4.621. "		
¹⁰ " "	"	4.610. Crystals.		
¹¹ Copper "	$\text{Cu C}_2\text{H}_2\text{O}_4 \cdot 4 \text{H}_2\text{O}$.	1.795. "		
¹² " "	"	1.811. Powder.		
¹³ Zinc "	$\text{Zn C}_2\text{H}_2\text{O}_4 \cdot 2 \text{H}_2\text{O}$.	2.339. "		
¹⁴ Potassium orthonitrophenate.		1.682. 20°.		
¹⁵ Silver "		2.661. 20°.		
¹⁶ Barium "		2.3301. 20°.		
¹⁷ Lead "	$\text{Pb}_2\text{C}_{12}\text{H}_8\text{N}_2\text{O}_7 \cdot \text{H}_2\text{O}$.	2.712. 20°.		
¹⁸ Potassium metanitrophenate.		1.691. 20°.		
¹⁹ Barium "		2.343. 20°.		
²⁰ Lead "	$\text{Pb C}_6\text{H}_5\text{N O}_4$.	2.694. 20°.		

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⁴ Schröder. B. D. C. G. 8. 199.	¹² Schröder. B. D. C. G. 8. 199.	¹⁸ Post & Mehrrens. B. D. C. G. 8. 1552.
⁵ Schröder. B. D. C. G. 8. 199.	¹³ Schröder. B. D. C. G. 8. 199.	¹⁹ Post & Mehrrens. B. D. C. G. 8. 1552.
⁶ Schröder. B. D. C. G. 8. 199.	¹⁴ Post & Mehrrens. B. D. C. G. 8. 1552.	²⁰ Post & Mehrrens. B. D. C. G. 8. 1552.

Name.	Formula.	Specific Gravity.	Boil. Point.	Melt. Point.
¹ Potassium paranitrophenate.		1.652. 20°.		
² Silver "		2.652. 20°.		
³ Barium "	Ba C ₁₂ H ₈ N ₂ O ₆ . 8 H ₂ O.	2.322. 20°.		
⁴ Lead "	Pb C ₆ H ₅ N O ₄ . 2 H ₂ O.	2.682. 20°.		
⁵ Potassium dinitrophenate.		1.778. 20°.		
⁶ Silver "		2.755. 20°.		
⁷ Barium "	Ba C ₁₂ H ₈ N ₄ O ₆ . 4 H ₂ O.	2.439. 20°.		
⁸ Lead "	Pb C ₆ H ₄ N ₂ O ₆ . 2 H ₂ O.	2.817. 20°.		
⁹ Potassium, 3 "		1.757. 20°.		
¹⁰ Silver "		2.733. 20°.		
¹¹ Barium "		2.406. 20°.		
¹² Lead "	Pb C ₁₂ H ₆ N ₄ O ₁₁	2.807. 20°.		
¹³ Potassium picrate.	K C ₆ H ₂ N ₃ O ₇ .	1.852. 20°.		
¹⁴ Silver "	Ag C ₆ H ₂ N ₃ O ₇ . H ₂ O.	2.816. 20°.		
¹⁵ Barium "	Ba C ₁₂ H ₄ N ₆ O ₁₄ . 4 H ₂ O.	2.518. 20°.		
¹⁶ Lead "	Pb C ₁₂ H ₄ N ₆ O ₁₄ . H ₂ O.	2.831. 20°.		

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XVIII. COMPOUNDS CONTAINING C. H. AND CL.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Chloride from diethyl carbinol.	$C_6 H_{11} Cl.$	.916. 0°. }	103°-105°.	
² " "	"	.895. 21°. }		
³ Amylene hydrochlorate.	"	.912. 0°. }		
⁴ " "	"	.891. 21°. }		
⁵ Hexyl chloride.	$C_6 H_{13} Cl.$	.895. 13°.	125°-128°.	
⁶ Octyl " "	$C_8 H_{17} Cl.$	.850.	182°.	
⁷ Ethylene " "	$C_2 H_4 Cl_2.$	1.272. 14°. }	61°.	
⁸ Ethylidene " "	"	1.201. 13°. }		
⁹ Propylene " "	$C_3 H_6 Cl_2.$	1.201. 15°.	117°.	
¹⁰ Propylidene " "	"	1.143. 10°.	8.5°-87°.	
¹¹ Chloroform.	$CHCl_3.$	1.502.	62°.	
¹² " "	"	1.500. 15°.	60°5.	
¹³ Monochloramylene.	$C_5 H_9 Cl.$	.872. 5°1.	87°.	
¹⁴ Monochloro benzol.	$C_6 H_5 Cl.$	1.12855. 0°.	From benzol.	
¹⁵ " "	"	1.11807. 9°79.		
¹⁶ " "	"	1.10467. 22°43.		
¹⁷ " "	"	1.04428. 77°27.		

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Monochloro benzol.	C_6H_5Cl	1.12818. 0°.	From phenol.	
² " "	"	1.11421. 9°.79.		
³ " "	"	1.10577. 22°.43.		
⁴ " "	"	1.04299. 77°.27.		
⁵ Dichlorobenzol.	$C_6H_4Cl_2$	1.3148.	172°-173°.	
⁶ " ortho.	"	1.3278. 0°.	179°.	
⁷ " meta.	"	1.307. 0°.	172°.	
⁸ Monochlorotoluol.	C_7H_7Cl	1.0735. 27°.2.	158°-161°.	
⁹ Dichlortoluol.	$C_7H_6Cl_2$	1.2596. 18°.4.	196°-198°.	
¹⁰ " "	"	1.2518. 16°.		
¹¹ Benzyl dichloride.	"	1.295. 16°.	212°-214°.	
¹² Trichlortoluol.	$C_7H_5Cl_3$	1.4093. 19°.5.	237°.	
¹³ Dichlorbenzotrichloride.	$C_7H_3Cl_5$	1.5829. 16°.	273°.	
¹⁴ Allylene dichloride.	$C_3H_4Cl_2$	1.233. 17°.5.	109°.	
¹⁵ " tetrachloride.	$C_3H_2Cl_4$	1.503. 17°.5.	171°.	
¹⁶ " "	"	1.482-1.485.	153°.	
¹⁷ Propargyl chloride.	C_3H_3Cl	1.0454. 5°.	65°.	
¹⁸ Pinacolic "	$C_8H_{18}Cl$	.8991. 0°.	112°.5-114°.5.	
¹⁹ Dichloroglycide.	$C_3H_4Cl_2$	1.21.		
²⁰ " "	"	1.22. 8°.	97°-98°.	
²¹ Naphtyl chloride.	$C_{10}H_7Cl$	1.2025. 15°.	251°-255°.	
²² Isoterebenthene chlorhydrate.	$C_{10}H_{17}Cl$.9927. 0°.	210°.	

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XIX. COMPOUNDS CONTAINING C. H. O. AND CL.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Deriv. of chloral hydrate.	$C_4 H_4 Cl_2 O_2$	1.4761. 17°.	185°.	
² Diacetyl chloral hydrate.	$C_8 H_7 Cl_2 O_4$	1.422. 11°.	221°-222°.	
³ Acetyl • chloral alcoholate.	$C_8 H_9 Cl_2 O_3$	1.327. 11°.	198°.	
⁴ Deriv. of chloral.	$C_7 H_{10} Cl_4 O_3$	1.42. 11°.		
⁵ " "	$C_8 H_8 Cl_4 O_3$	1.73. 17°.		
⁶ Tetrachlorinated ether.	$C_4 H_8 Cl_4 O$	1.4379. 0°.	189°·7.	
⁷ " "	"	1.4182. 15°·2.		
⁸ " "	"	1.3055. 99°·9.		
⁹ Pentachlorinated ether.	$C_4 H_5 Cl_5 O$	1.577. 8°.	235°.	
¹⁰ Dichloracetone.	$C_3 H_4 Cl_2 O$	1.326. 0°.	121°·5.	
¹¹ Monochloracetal	$C_6 H_{12} Cl O_2$	1.0418. 0°.	156°·8.	
¹² " "	"	1.0416. 26°·3.		
¹³ " "	"	.9315. 99°·9.		
¹⁴ Monochloracetin	$C_5 H_9 Cl O_3$	1.27. 9°.	230°.	
¹⁵ Bichloracetin.	$C_5 H_8 Cl_2 O_3$	1.274. 8°.	194°-195°.	

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Methyl monochloracetate.	$C_2 H_5 Cl O_2$.	1.22. 15°.	126°-127°.	
² Methylene chloracetate.	"	1.1953. 14°.2.	115°-116°.	
³ Paradichloraldehyde.	$C_2 H_2 Cl_2 O$.	1.69. Solid.		129°-130°
⁴ Deriv. of valerylene.	$C_4 H_7 Cl O_2$.	1.065. 15°.		
⁵ Monochlorhydrin.	$C_3 H_7 Cl O_2$.	1.4. 13°.	230°-235°.	
⁶ Ether of monochlorhydrin.	$C_6 H_{11} Cl O_2$.	1.117. 11°.	183°-185°.	
⁷ Dichlorhydrin.	$C_2 H_6 Cl_2 O$.	1.369. 9°.	179°-180°.	
⁸ "	"	1.383. 19°.	171°-171°5.	
⁹ Propyl glycol chlorhydrin.	$C_3 H_7 Cl O$.	1.132. 17°.	160°.	
¹⁰ Diallyl dichlorhydrin	$C_6 H_{12} Cl_2 O_2$.	1.4. 7°.		
¹¹ Chlorodracylic chloride.		1.377.	220°-222°.	
¹² Chloranethol.	$C_{10} H_{11} Cl O$.	1.191. 20°.	228°-230°.	3°-4°.
¹³ Ethyl ortho dichlorobenzoate.	$C_9 H_8 Cl_2 O_2$.	1.3278. 0°.	271°.	
¹⁴ Monochlorophenol.	$C_6 H_5 Cl O$.	1.306. 20°.5.	218°-219°.	
¹⁵ Benzophenone chloride.		1.235. 18°5.	298°-300°.	

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XX. COMPOUNDS CONTAINING C. H. Cl. N.; OR C. H. Cl. N. O.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Dichlorethylamine.	$C_2H_5Cl_2N$.	1.2397. 5°. } 1.2300. 15° }	88°-89°.	
² " "	"			
³ Chloracetone-trile.	C_3H_2ClN .	1.204. 11°.2.	123°-124°.	
⁴ " "	"	1.193. 20°.	126°-127°.	
⁵ Dichloracetone-trile.	C_3HCl_2N .	1.374. 11°.4.	112°-113°.	
⁶ Trichloracetone-trile.	C_3Cl_3N .	1.439. 12°.2.	83°-84°.	
⁷ Chloroxalethylene.	$C_6H_5ClN_2$.	1.1420. 15°.	217°-218°.	
⁸ Ortho chloraniline.	C_6H_6ClN .	1.2338. 0°.	207°.	
⁹ Meta " "	"	1.2432. 0°.	230°.	
¹⁰ Chloronitro methane.	CH_3ClNO_2 .	1.466. 15°.	122°-123°.	
¹¹ Deriv. of acetonilide.	$C_6H_7ClNO.HOCl$.	1.3893. 20°.		
¹² Chloronitro toluol.	$C_7H_6ClNO_2$.	1.300. 20°.	249°.	

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XXI. ORGANIC COMPOUNDS CONTAINING BROMINE.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Ethyl bromide.	C ₂ H ₅ Br.	1.4775. 5°-10°.	38°-39°.	
² " "	"	1.4679. 10°-15°.		
³ " "	"	1.4582. 15°-20°.		
⁴ " "	"	1.385. 15°.		
⁵ " "	"	1.47. 15°.		
⁶ Butylene "	C ₄ H ₈ Br ₂ .	1.8503. 0°.	164°-165°.	
⁷ " "	"	1.8204. 20°.		
⁸ Amylene "	C ₅ H ₁₀ Br ₂ .	1.3443. 0°.	170°-175°.	
⁹ " "	"	1.7087. 0°.		
¹⁰ " "	"	1.6868. 14°.	178°.	
¹¹ Hexylene "	C ₆ H ₁₂ Br ₂ .	1.6058. 0°.		
¹² " "	"	1.5809. 19°.	195°-197°.	
¹³ " "	"	1.6497. 0°.		
¹⁴ Dibromomethane.	C H ₂ Br ₂ .	2.0844. 11°.	80°-82°.	
¹⁵ Bromo-ethylene bromide.	C ₂ H ₂ Br ₂ .	2.624. 16°.		
¹⁶ " "	"	2.65. 0°.	184°-185°.	
¹⁷ Bromo-propylene, α .	C ₃ H ₃ Br.	1.364. 19°.		
¹⁸ " " β .	"	1.428. 19°.	59°-60°.	
¹⁹ Bromo- β propylene bromide.	C ₃ H ₃ Br ₂ .	2.356. 18°.		
²⁰ " " "	"		200°-201°.	

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Monobromo hexylene.	$C_6 H_{11} Br.$	1.2205. 0°. }	140°-141°.	
² " " "	"	1.2025. 15°. }		
³ Propargyl bromide.	$C_3 H_3 Br.$	1.52. 20°.	88°-90°.	
⁴ " " "	"	1.59. 11°.	88°-90°.	
⁵ " tribromide.	$C_3 H_3 Br_3.$	2.53. 10°.		
⁶ " tetrabromide.	$C_3 H_3 Br_4.$	3.01. 10°.		
⁷ Dipropargyl tetrabromide.	$C_6 H_6 Br_4.$	2.464. 19°.	205°-210°.	
⁸ Dibromo diallyl.	$C_6 H_8 Br_2.$	1.656.		
⁹ Acetylene dibromide.	$C_2 H_2 Br_2.$	2.120. 17°.	157°	
¹⁰ " tetra-bromide.	$C_2 H_2 Br_4.$	2.848. 21° 5.		
¹¹ Monobromo benzol.	$C_6 H_5 Br.$	1.51768. 0°. }	154° 86. 155° 52.	
¹² " " "	"	1.50236. 11° 46. }		
¹³ " " "	"	1.48977. 20° 96. }		
¹⁴ " " "	"	1.41163. 77° 76. }		
¹⁵ " " "	"	1.519. } 0°.	154°.	
¹⁶ " " "	"	1.522. }		
¹⁷ Ortho bromo toluol.	$C_7 H_7 Br.$	1.401. 18°.	182°-183°.	
¹⁸ Methyl bibromopropionate, α .	$C_4 H_6 Br_2 O_2.$		203°.	
¹⁹ " " β .	"	1.9043. 0°. }	175°-179°.	
²⁰ " " "	"	1.8973. 12°. }		

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Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Ethyl bibromo- propionate, <i>a</i> .	$C_5 H_8 Br_2 O_2$.	1.7728. 0°.	190°-191°.	
² " " "	"	1.7536. 12°.		
³ " " <i>β</i> .	"	1.796. 0°.		
⁴ " " "	"	1.777. 15°.		
⁵ Propyl " <i>a</i> .	$C_6 H_{10} Br_2 O_2$.	1.6842. 0°.	200°-204°.	
⁶ " " "	"	1.6632. 12°.		
⁷ Butyl " "	$C_7 H_{12} Br_2 O_2$.	1.6008. 0°.	213°-218°.	
⁸ " " "	"	1.5778. 12°.		
⁹ Allyl " <i>β</i> .	$C_6 H_8 Br_2 O_2$.	1.843. 0°.	215°-220°.	
¹⁰ " " "	"	1.818. 20°.		
¹¹ Ethyl bromiso- butyrate.	$C_6 H_{11} Br O_2$	1.328. 0°.	158°-159°.	
¹² " " "	"	1.300. 19°.5.		
¹³ Bromodiethylin.	$C_7 H_{15} Br O_2$.	1.258. 8°.	<i>a</i> 200°.	
¹⁴ Monobrom-eth- ylallyl oxide.	$C_5 H_9 Br O$.	1.27. 12°.	130°-135°.	
¹⁵ Bibromo allyl oxide.	$C_6 H_8 Br_2 O$.	1.7. 17°.	212°-215°.	
¹⁶ Bromo bromo- cetin.	$C_4 H_6 Br_2 O_2$.	1.98. 0°.	193°-195°.	
¹⁷ ———	$C_2 H_4 Br_2 O$.	2.35. 0°.	179°-181°.	
¹⁸ Dibromhydrin.	$C_3 H_6 Br_2 O$.	2.02. 18°.5.	214°-220°.	
¹⁹ Bromotoluidine.	$C_7 H_8 Br N$.	1.510. 20.	240°.	8°.
²⁰ Chlorobromhy- drin.	$C_3 H_6 Cl Br O$.	1.764. 9°.	197°.	
²¹ Chloro dibromo nitro methane.	$C Cl Br_2 N O_2$.	2.421. 15°.		
²² Chlorobromoni- trin.	$C_3 H_5 Cl Br N O_3$.	1.7904. 9°.		

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⁷ Philippi. Göttingen In- aug. Diss. 1873.	¹⁴ L. Henry. B. D. C. G. 5. 186.	²¹ Tscherniak. B. D. C. G. 8. 610.
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Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Carbon chlorobromide.	$C Cl_3 Br.$	2.058. 0°.	104°. 140°-141°. 93°-95°. 110°. 120°.	
² " "	"	1.842. 100°.		
³ Propylene "	$C_3 H_6 Cl Br.$	1.63. 8°.		
⁴ " "	"	1.474. 21°.		
⁵ " "	"	1.60. 20°.		
⁶ " "	"	—	Four isomers.	

XXII. ORGANIC COMPOUNDS CONTAINING IODINE.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
⁷ Methyl iodide.	$C H_3 I.$	2.2905. 16°.	41°-8.	
⁸ Ethyl "	$C_2 H_5 I.$	1.9567. 5°-10°.		
⁹ " "	"	1.9457. 10°-15°.		
¹⁰ " "	"	1.9348. 15°-20°.		
¹¹ Iodide from diethylcarbinol.	$C_6 H_{11} I.$	1.528. 0°.	145°-146°.	
¹² " "	"	1.501. 20°.		
¹³ Amylene hydriodate.	"	1.539. 0°.	144°-145°.	
¹⁴ " "	"	1.510. 20°.		
¹⁵ " "	"	1.5207. 0°.	129°-130°.	
¹⁶ " "	"	1.4954. 19°.		
¹⁷ Isohexyl iodide.	$C_6 H_{13} I.$		164°-166°.	
¹⁸ Pinacolic "	"	1.4739. 0°.	140°-144°.	
¹⁹ Ethylidene "	$C_2 H_4 I_2.$	2.84. 0°.	177°-179°.	

AUTHORITIES.

¹ Paterno. B. D. C. G. 5. 289.	⁷ Sigel. A. C. P. 170. 345.	¹⁵ Flavitzky. A. C. P. 179. 348.
² Paterno. B. D. C. G. 5. 289.	⁸ Regnault. P. A. 62. 50.	¹⁶ Flavitzky. A. C. P. 179. 348.
³ Reboul. B. D. C. G. 7. 1037.	⁹ Regnault. P. A. 62. 50.	¹⁷ Oechsner de Coninck. C. R. 82. 93.
⁴ Reboul. B. D. C. G. 7. 1037.	¹⁰ Regnault. P. A. 62. 50.	¹⁸ Friedel & Silva. C. S. J. (2). 11. 488.
⁵ Reboul. B. D. C. G. 7. 1037.	¹¹ Wagner & Saytzeff. A. C. P. 179. 318.	¹⁹ Gustavson. B. S. C. 22. 13.
⁶ Reboul. B. D. C. G. 7. 1037.	¹² Wagner & Saytzeff. A. C. P. 179. 318.	
	¹³ Wagner & Saytzeff. A. C. P. 179. 318.	
	¹⁴ Wagner & Saytzeff. A. C. P. 179. 318.	

Supp.-D.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Vinyl iodide.	$C_2 H_3 I.$	2.09. 0°.	56°.	
² Acetylene diiodide.	$C_2 H_2 I_2.$	3.303. 21° Solid.		73°s.70°
³ " "	"	2.942. 21° Fluid.		
⁴ Diiodhydrin.	$C_2 H_4 I_2 O.$	2.4.		
⁵ Ortho chloriodobenzol.	$C_6 H_4 I Cl.$	1.928. 24°5.	229°-230°.	
⁶ Bichloro iodhydrin.	$C_2 H_3 Cl_2 I.$	2.0476. 9°.	205°.	
⁷ Chlorobromiodhydrin.	$C_2 H_3 Cl Br I.$	2.325. 9°.		
⁸ Ethylene bromiodide.	$C_2 H_4 Br I.$	2.516. 29°.	162°-167°.	28°.
⁹ " "	"	2.514. 30°.	163°.	27°7.
¹⁰ Ethylidene "	"	2.705. 18° S.	}	
¹¹ " "	"	2.452. 16° L.		
¹² Iododibromovinyl.	$C_2 H_3 Br_2 I.$	2.86. 29°.		

XXIII. ORGANIC COMPOUNDS CONTAINING SULPHUR.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹³ Butyl sulphide.	$C_8 H_{18} S.$.8523. 0°.	} 182°.	
¹⁴ " "	"	.8386. 16°.		
¹⁵ " "	"	.8317. 23°.		
¹⁶ Ethyl sulphhydrate.	$C_2 H_6 S.$.8456. 5°-10°.	}	
¹⁷ " "	"	.8406. 10°-15°.		
¹⁸ " "	"	.8356. 15°-20°.		

AUTHORITIES.

¹ Gustavson. B. D. C. G. 7.	⁶ L. Henry. B. D. C. G. 4.	¹² Simpson. C. N. 29. 53.
731.	701.	¹³ Grabowsky & Saytzeff.
² Sabanejeff. A. C. P. 178.	⁷ L. Henry. B. D. C. G. 4.	A. C. P. 175. 351.
119.	701.	¹⁴ Grabowsky & Saytzeff.
³ Sabanejeff. A. C. P. 178.	⁸ Simpson. C. N. 29. 53.	A. C. P. 175. 351.
121.	⁹ Friedel. C. R. 79. 164.	¹⁵ Reymann. C. S. J. (2). 13.
⁴ Nahmacher. B. D. C. G.	¹⁰ Lagermarck. B. D. C. G.	141.
5. 356.	7. 907.	¹⁶ Regnault. P. A. 62. 50.
⁵ Beilstein & Kurbatow. A.	¹¹ Lagermarck. B. D. C. G.	¹⁷ Regnault. P. A. 62. 50.
C. P. 176. 43.	7. 907.	¹⁸ Regnault. P. A. 62. 50.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Butyl sulphydrate.	C ₄ H ₁₀ S.	.858. 0°.	}	84°-85°. 235°-236°. 230°-231°. 233°.
² " "	"	.843. 16°.		
³ " "	"	.8299. 17°.		
⁴ Cymol "	C ₁₀ H ₁₄ S.	.9975. 17°.5.		
⁵ " "	"	.989.		
⁶ " "	"	.995.	233°.	
⁷ Methyl cymol sulphydrate.	C ₁₁ H ₁₆ S.	.986.	244°.	
⁸ Ethyl ethylsulphacetate.	C ₆ H ₁₂ S O ₂ .	1.047. 4°.	187°-189°.	
⁹ " amylsulphacetate.	C ₉ H ₁₈ S O ₂ .	.979.	230°.	
¹⁰ " phenylsulphacetate.	C ₁₀ H ₁₂ S O ₂ .	1.136.	}	276°-278°. p. d.
¹¹ " "	"	1.1269. 15°.		
¹² Methyl disulpho-carbonate.	C ₃ H ₆ S ₂ O.	1.176. 18°.	167°-168°.	
¹³ Xanthogenic ether.	C ₄ H ₈ S ₂ O.	1.12. 18°.	184°.	
¹⁴ Isomer of xanthogenic ether.	"	1.129. 18°.	184°.	
¹⁵ Butyl sulphethyl-dioxy-carbonate.	C ₇ H ₁₄ S ₂ O.	.9939. 10°.	190°-195°.	
¹⁶ Ethyl sulphobutyldioxy-carbonate.	"	.9938. 10°.	190°-193°.	
¹⁷ Ethyl sulphocyanide.	C ₃ H ₅ N S.	1.033. 0°.	}	146°.
¹⁸ " "	"	1.01261. 19°.		
¹⁹ " "	"	1.00238. 22°.		
²⁰ " "	"	.870135.		
²¹ " "	"	.869367.		

AUTHORITIES.

¹ Grabowsky & Saytzeff. A. C. P. 175. 351.	⁷ Bechler. Leipzig Inaug. Diss. 1873.	¹⁴ Salomon. J. F. P. (2). 8. 114.
² Grabowsky & Saytzeff. A. C. P. 175. 351.	⁸ Claesson. B. D. C. G. 8. 121.	¹⁵ Mylius. B. D. C. G. 6. 312.
³ Reymann. C. S. J. (2). 13. 141.	⁹ Claesson. B. D. C. G. 8. 122.	¹⁶ Mylius. B. D. C. G. 6. 312.
⁴ Flesch. C. Cent. 4. 519.	¹⁰ Claesson. B. S. C. 23. 443.	¹⁷ Buff. B. D. C. G. 1. 206.
⁵ Fittica. A. C. P. 172. 326.	¹¹ Claesson. B. S. C. 23. 443.	¹⁸ Buff. B. D. C. G. 1. 206.
⁶ Bechler. Leipzig Inaug. Diss. 1873.	¹² Salomon. J. F. P. (2). 8. 114.	¹⁹ Buff. B. D. C. G. 1. 206.
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1	Buff.	B. D. C. G.	1. 206.	9	Uppenkamp.	B. D. C. G.	16	Miquel.	C. R.	81. 1209.
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4	Buff.	B. D. C. G.	1. 206.	11	Buff.	B. D. C. G.	1. 206.		186.	5.
5	Buff.	B. D. C. G.	1. 206.	12	Buff.	B. D. C. G.	1. 206.	19	Ratlake.	A. C. P.
6	Buff.	B. D. C. G.	1. 206.	13	Gerlich.	B. D. C. G.	8.		198.	167.
7	Gerlich.	B. D. C. G.	8.		653.		20	Salomon.	J. F. P. (2).	7.
	651.			14	Gerlich.	B. D. C. G.	8.		254.	
8	Gerlich.	B. D. C. G.	8.		653.					
	651.			15	Billeter.	C. Cent.	6.	101.		

XXIV. MISCELLANEOUS ORGANIC COMPOUNDS.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Phosphenyl chloride.	$C_6H_5P Cl_2$.	1.319. 20°.	222°.	
² " oxychloride.	$C_6H_5P Cl_2 O$.	1.375. 20°.	260°.	
³ Dimethyl phenyl phosphin.	$C_6H_{11}P$.	.9768. 11°.	192°.	
⁴ Diethyl " "	$C_{10}H_{15}P$.	.9571. 13°.	221.9°.	
⁵ Tripropyl borate.	$C_9H_{21}BO_3$.	.867. 16°.	175°.	
⁶ Silicon phenyl triethyl.	$C_{12}H_{20}Si$.	.9042. 0°.	230°.	
⁷ Propyl silicate.	$C_{12}H_{20}SiO_4$.	.915. 18°.	225°-227°.	
⁸ Butyl " "	$C_{16}H_{36}SiO_4$.	.953. 15°.	256°-260°.	
⁹ Ethyl orthosilicoacetate.	$C_7H_{18}SiO_3$.	.9283. 0°.	145°-151°.	
¹⁰ Methyl orthosilicopropionate.	$C_5H_{14}SiO_3$.	.9747. 0°.	125°-126°.	
¹¹ Ethyl orthosilicobenzoate.	$C_{12}H_{20}SiO_3$.	1.0133. 0°.	224°-229°.	
¹² " " "	" "	1.0055. 10°.		
¹³ Silicon triethyl oxide.	$C_{12}H_{30}Si_2O$.	.8831. 0°.	224°-229°.	
¹⁴ Propyl silicic monochlorhydrin.	$C_9H_{21}SiClO_3$.	.980.	208°-210°.	
¹⁵ Propyl silicic dichlorhydrin.	$C_8H_{14}SiCl_2O_3$.	1.028.	185°-188°.	
¹⁶ Deriv. of silicon phenyl triethyl.	$C_{12}H_9SiCl$.	1.0185. 0°.	260°-265°.	
¹⁷ Zinc propyl.	$(C_3H_7)_2Zn$.		158°-160°.	
¹⁸ " " "	" "	1.098. 15°.	a. 146.	
¹⁹ " butyl.	$(C_4H_9)_2Zn$.		185°-188°.	

AUTHORITIES.

¹ Michaelis. C. Cent. 4. 543.	⁷ Cahours. C. Cent. 4. 482.	¹³ Ladenburg. B. D. C. G. 4. 730.
² Michaelis. C. Cent. 4. 548.	⁸ Cahours. C. Cent. 5. 20.	¹⁴ Cahours. C. Cent. 4. 482.
³ Michaelis. B. D. C. G. 8. 494.	⁹ Ladenburg. C. S. J. (2). 12. 40.	¹⁵ Cahours. C. Cent. 4. 482.
⁴ Michaelis. B. D. C. G. 8. 498.	¹⁰ Ladenburg. A. C. P. 173. 143.	¹⁶ Ladenburg. A. C. P. 173. 143.
⁵ Cahours. C. Cent. 4. 482.	¹¹ { Ladenburg. C. S. J. (2). 11. 1026.	¹⁷ Cahours. B. S. C. 20. 190.
⁶ Ladenburg. C. Cent. 5. 312.	¹² { Ladenburg. C. S. J. (2). 11. 1028.	¹⁸ Gladstone & Tribe. C. S. J. (2). 11. 968.
		¹⁹ Cahours. C. Cent. 5. 20.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melting Point.
¹ Ethyl isosulphocyanide.	C_2H_5NS	1.01913. } 0° .	133°.2.	
² " " "	"	1.019375. }		
³ " " "	"	.997525. 21°.4.		
⁴ " " "	"	.997235. 22°.		
⁵ " " "	"	.87909. }		
⁶ " " "	"	.873513. } 133°.2.		
⁷ Isopropylsulphocyanide.	C_4H_7NS	.989. 0° .	152°-153°.	
⁸ " " "	"	.974. 15°.		
⁹ Hexyl " "	$C_7H_{13}NS$	.9253.	197°-198°.	
¹⁰ Amyl isosulphocyanide.	$C_8H_{11}NS$	.957538. 0° .	182°.	
¹¹ " " "	"	.94189. 17°.		
¹² " " "	"	.78749. 182°.		
¹³ Allyl sulphocyanide.	C_4H_5NS	1.071. 0° .	148°-149°.	
¹⁴ " " "	"	1.056. 15°.		
¹⁵ Phenyl " "	C_7H_5NS	1.155. 17°.5.	231°.	
¹⁶ Acetyl " "	C_3H_5ONS	1.151. 16°.	131°-132°.	
¹⁷ Benzoyl " "	C_8H_5ONS	1.197. 16°.	200°-205° in vacuo	
¹⁸ Monochlorallyl sulphocyanide.	C_4H_4ClNS	1.27. 12°.	185°.	
¹⁹ Perchloromethyl mercaptan.	$CSCl_4$	1.712. 12°.8.	146.5-148°.	
²⁰ Carbonyl sulphethyl chloride.	C_2H_5ClSO	1.184. 16°.	136°.	

AUTHORITIES.

¹ Buff. B. D. C. G. 1. 206.	⁹ Uppenkamp. B. D. C. G. 8. 56.	¹⁶ Miquel. C. R. 81. 1200.
² Buff. B. D. C. G. 1. 206.		¹⁷ Miquel. C. R. 81. 1210.
³ Buff. B. D. C. G. 1. 206.	¹⁰ Buff. B. D. C. G. 1. 206.	¹⁸ L. Henry. B. D. C. G. 5.
⁴ Buff. B. D. C. G. 1. 206.	¹¹ Buff. B. D. C. G. 1. 206.	186.
⁵ Buff. B. D. C. G. 1. 206.	¹² Buff. B. D. C. G. 1. 206.	¹⁹ Rathke. A. C. P. 167.
⁶ Buff. B. D. C. G. 1. 206.	¹³ Gerlich. B. D. C. G. 8.	198.
⁷ Gerlich. B. D. C. G. 8.	653.	²⁰ Salomon. J. F. P. (2). 7.
⁸ Gerlich. B. D. C. G. 8.	¹⁴ Gerlich. B. D. C. G. 8.	254.
651.	653.	
	¹⁵ Billeter. C. Cent. 6. 101.	

XXIV. MISCELLANEOUS ORGANIC COMPOUNDS.

Name.	Formula.	Specific Gravity.	Boiling Point.	Melt. Point.
¹ Phosphenyl chloride.	$C_6 H_5 P Cl_2$.	1.319. 20°.	222°.	
² " oxychloride.	$C_6 H_5 P Cl_2 O$.	1.375. 20°.	260°.	
³ Dimethyl phenyl phosphin.	$C_8 H_{11} P$.	.9768. 11°.	192°.	
⁴ Diethyl " "	$C_{10} H_{15} P$.	.9571. 13°.	221.9°.	
⁵ Tripropyl borate.	$C_9 H_{21} B O_3$.	.867. 16°.	175°.	
⁶ Silicon phenyl triethyl.	$C_{12} H_{30} Si$.	.9042. 0°.	230°.	
⁷ Propyl silicate.	$C_{12} H_{26} Si O_4$.	.915. 18°.	225°-227°.	
⁸ Butyl " "	$C_{16} H_{36} Si O_4$.	.953. 15°.	256°-260°.	
⁹ Ethyl orthosilicoacetate.	$C_7 H_{18} Si O_3$.	.9283. 0°.	145°-151°.	
¹⁰ Methyl orthosilicopropionate.	$C_8 H_{14} Si O_4$.	.9747. 0°.	125°-126°.	
¹¹ Ethyl orthosilicobenzoate.	$C_{12} H_{20} Si O_3$.	1.0133. 0°.	} 224°-229°.	
¹² " " "	" "	1.0055. 10°.		
¹³ Silicon triethyl oxide.	$C_{12} H_{30} Si_2 O$.	.8831. 0°.	224°-229°.	
¹⁴ Propyl silicic monochlorhydrin.	$C_9 H_{21} Si Cl O_3$.	.980.	208°-210°.	
¹⁵ Propyl silicic dichlorhydrin.	$C_8 H_{14} Si Cl_2 O_3$.	1.028.	185°-188°.	
¹⁶ Deriv. of silicon phenyl triethyl.	$C_{12} H_9 Si Cl$.	1.0185. 0°.	260°-265°.	
¹⁷ Zinc propyl.	$(C_3 H_7)_2 Zn$.		158°-160°.	
¹⁸ " " "	" "	1.098. 15°.	a. 146.	
¹⁹ " butyl.	$(C_4 H_9)_2 Zn$.		185°-188°.	

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¹ Michaelis. C. Cent. 4. 543.	⁷ Cahours. C. Cent. 4. 482.	¹³ Ladenburg. B. D. C. G. 4. 730.
² Michaelis. C. Cent. 4. 548.	⁸ Cahours. C. Cent. 5. 20.	¹⁴ Cahours. C. Cent. 4. 482.
³ Michaelis. B. D. C. G. 8. 494.	⁹ Ladenburg. C. S. J. (2). 12. 40.	¹⁵ Cahours. C. Cent. 4. 482.
⁴ Michaelis. B. D. C. G. 8. 498.	¹⁰ Ladenburg. A. C. P. 173. 143.	¹⁶ Ladenburg. A. C. P. 173. 143.
⁵ Cahours. C. Cent. 4. 482.	¹¹ { Ladenburg. C. S. J. (2). 11. 1026.	¹⁷ Cahours. B. S. C. 20. 190.
⁶ Ladenburg. C. Cent. 5. 312.	¹² { Ladenburg. C. S. J. (2). 11. 1026.	¹⁸ Gladstone & Tribe. C. S. J. (2). 11. 968.
		¹⁹ Cahours. C. Cent. 5. 20.

SPECIFIC GRAVITY TABLES.

Name.	Formula.	Specific Gravity	Boiling Point.	Melt. Point.
¹ Mercury butyl.	(C ₄ H ₉) ₂ Hg.	1.835. 15°.	205°-207°.	
² Aluminum propyl.	(C ₃ H ₇) ₃ Al ₂ .		248°-252°.	
³ Glucinum ethyl.	(C ₂ H ₅) ₂ Gl.		185°-188°.	
⁴ " propyl.	(C ₃ H ₇) ₂ Gl.		244°-246°.	
⁵ Stann tetrapropyl.	(C ₃ H ₇) ₄ Sn.	1.179. 14°.	222°-225°.	
⁶ Stanntributyl iodide.	C ₁₂ H ₂₇ Sn I.	1.540. 15°.	292°-296°.	

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¹ Cahours. C. Cent. 5. 20.	² Cahours. C. Cent. 4. 482.	⁵ Cahours. B. S. C. 20. 190.
³ Cahours. B. S. C. 20. 190.	⁴ Cahours. C. Cent. 4. 482.	⁶ Cahours. C. Cent. 5. 20.

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SMITHSONIAN MISCELLANEOUS COLLECTIONS.

276

THE

CONSTANTS OF NATURE.

PART II.

A TABLE OF SPECIFIC HEATS

FOR

SOLIDS AND LIQUIDS.

COMPILED BY

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ADVERTISEMENT.

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JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, APRIL, 1876.

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INTRODUCTION.

THE following tables of Specific Heat for Solids and Liquids are believed to be practically complete up to October, 1875. Of course it was not considered necessary to include much very old material, there being little of value prior to the time of Dulong and Petit. Undoubtedly the oldest determinations have a certain historical value, but this would be hardly sufficient to warrant the labor involved in searching them out. However, quite a number of such determinations have been included in the tables, notably some by Dalton, Crawford, Gadolin, and Lavoisier and Laplace.

For convenience, the columns of atomic or molecular heats have been added. These values, it is hardly necessary to say, are the products obtained by multiplying the specific heat of a substance into its atomic or molecular weight. For this purpose the most recent determinations of atomic weight have been employed.

Details concerning the methods of determination could not well be given in such tables as these. For such details the original papers must be consulted, and to these original papers references are almost always supplied.

F. W. C.

CINCINNATI, Jan. 5, 1876.

A LIST

OF SOME OF THE MORE IMPORTANT PAPERS UPON SPECIFIC HEAT.*

1. DULONG AND PETIT.—“Recherches sur la mesure des températures, et sur les lois de la communication de la chaleur.” *Ann. Chim. Phys.* (2). 7; pages 113 and 225. 1817.
2. DULONG AND PETIT.—“Recherches sur quelques points importants de la théorie de la chaleur.” *Ann. Chim. Phys.* (2). 10. 395. 1819.
3. WEBER.—“Ueber die specifische Wärme fester Körper, insbesondere der Metalle.” *Poggend. Annal.* 20. 178. 1830.
4. NEUMANN.—“Untersuchungen über die specifische Wärme der Mineralien.” *Poggend. Annal.* 23. 1. 1831.
5. NEUMANN.—“Bestimmung der specifischen Wärme des Wassers in der Nähe des Siedpunkts gegen Wasser von niedriger Temperatur.” *Poggend. Annal.* 23. 40. 1831.
6. AVOGADRO.—“Mémoire sur les chaleurs spécifiques des corps solides et liquides.” *Ann. Chim. Phys.* (2). 55. 80. 1833.
7. AVOGADRO.—“Nouvelles recherches sur la chaleur spécifique des corps solides et liquides.” *Ann. Chim. Phys.* (2). 57. 113. 1834.
8. REGNAULT.—“Recherches sur la chaleur spécifique des corps simples et composés.” *Ann. Chim. Phys.* (2). 73. 5. 1840. *Poggend. Annal.* 51. 44 and 213.
9. SCHRÖDER.—“Ueber die specifische Wärme zusammengesetzter Körper. Ein Beitrag zur Volumentheorie.” *Poggend. Annal.* 52. 269. 1841.
10. DELARIVE AND MARCET.—“Einige Untersuchungen über die specifische Wärme.” *Poggend. Annal.* 52. 120. 1841.

* No attempt at completeness is made in this list. It is intended merely as a guide to the literature of the subject, useful in connection with the following tables. Papers earlier than those of Dulong and Petit, and many very important papers upon the specific heat of gases, are entirely omitted. Among such papers may be mentioned those of Clement and Desormes, Delaroche and Bérard, Lavoisier and Laplace, Irvine, Crawford, Wilke, Black, Haycraft and Mayer.

11. REGNAULT.—“Sur la chaleur spécifique des corps simples et des corps composés.” *Ann. Chim. Phys.* (3). 1. 129. 1841. *Poggend. Annal.* 53. 60 and 243.
12. DELARIVE AND MARCET.—“Ueber die specifische Wärme des Kohlenstoffs in seinen verschiedenen Zuständen.” *Poggend. Annal.* 54. 125. 1841.
13. REGNAULT.—“Recherches sur les chaleurs spécifiques.” *Ann. Chim. Phys.* (3). 9. 322. 1843. *Poggend. Annal.* 62. 50.
14. DESAINS.—“Mémoire sur la chaleur spécifique de la glace.” *Compt. Rend.* 20. 1345. 1845. *Ann. Chim. Phys.* (3). 14. 306. *Poggend. Annal.* 65. 435.
15. PERSON.—“Recherches sur la chaleur latente.” *Compt. Rend.* 23. 162. 1846. *Poggend. Annal.* 70. 300.
16. KOPP.—“Ueber die specifische Wärme einiger Flüssigkeiten.” *Poggend. Annal.* 75. 98. 1848.
17. WOESTYN.—“Ueber die specifischen Wärmen.” *Poggend. Annal.* 76. 129. 1849.
18. REGNAULT.—“Note sur la chaleur spécifique et la chaleur latente du fusion du brome, et sur la chaleur spécifique du mercure solide.” *Ann. Chim. Phys.* (3). 26. 268. 1849. *Poggend. Annal.* 78. 118.
19. REGNAULT.—“Ueber die specifische Wärme des flüssigen Wassers bei verschiedenen Temperaturen.” *Poggend. Annal.* 79. 241. 1850.
20. PERSON.—“Recherches sur la chaleur spécifique des dissolutions salines.” *Ann. Chim. Phys.* (3). 33. 437. 1851. *Ann. Chem. Pharm.* 80. 136.
21. GARNIER.—“Recherches sur les rapports entre le poids atomique moyen des corps simples, et leur chaleur spécifique.” *Compt. Rend.* 35. 278. 1852. *Ann. Chem. Pharm.* 84.
22. REGNAULT.—“Recherches sur les chaleurs spécifiques des fluides élastiques.” *Compt. Rend.* 36. 676. 1853. *Poggend. Annal.* 89. 335.
23. REGNAULT.—“Note sur la chaleur spécifique du phosphore rouge.” *Ann. Chim. Phys.* (3). 38. 129. 1853. *Poggend. Annal.* 89. 495.
24. ANGSTRÖM.—“Notiz über die latente und specifische Wärme des Eises.” *Poggend. Annal.* 90. 509. 1853.
25. REGNAULT.—“Mémoire sur la chaleur spécifique de quelques corps simples, et sur les modifications isomériques du sélénium.” *Ann. Chim. Phys.* (3). 46. 257. 1856. *Poggend. Annal.* 98. 396.
26. REGNAULT.—“Sur la chaleur spécifique de quelques corps simples.” *Ann. Chim. Phys.* (3). 63. 5. 1861.
27. REGNAULT.—“Sur la chaleur spécifique du thallium.” *Ann. Chim. Phys.* (3). 67. 427. 1863.
28. KOPP.—“Ueber die specifische Wärme starrer Körper, und Folgerungen bezüglich der zusammengesetztheit s. g. chemischer Elemente.” *Ann. Chem. Pharm.* 126. 362. 1864.

29. PAPE.—"Ueber die specifische Wärme wasserfreier und wasserhaltiger schwefelsaurer Salze." Poggend. Annal. 120. 337 and 579. 1864.
30. REGNAULT.—"Bemerkungen über die zur Bestimmung der specifischen Wärme fester Körper angewendeten Verfahren." Poggend. Annal. 122. 257. 1864.
31. BOHN.—"Noch einige Bemerkungen über die Bestimmung der specifischen Wärme aus Mischversuchen." Poggend. Annal. 122. 289. 1864.
32. PAPE.—"Ueber die specifische Wärme unterschwefligsaurer Salze." Poggend. Annal. 122. 408. 1864.
33. NEUMANN.—"Beobachtungen über die specifische Wärme verschiedener, namentlich zusammengesetzter Körper." Poggend. Annal. 126. 123. 1865.
34. KOPP.—"Investigations of the specific heat of solid bodies." Phil. Trans. 1865. 71. Ann. Chem. Pharm. 3rd. supp. bd. Chem. Soc. Journ. 1866.
35. BUFF.—"Ueber eine Beziehung der Valenz der Atome zu der specifischen Wärme derselben." Ann. Chem. Pharm. 4th. supp. bd. 164. 1865-6.
36. BETTENDORF AND WÜLLNER.—"Einige Versuche über specifische Wärme allotroper Modificationen." Poggend. Annal. 133. 293. 1868.
37. SCHÜLLER.—"Ueber die specifische Wärme von Salzlösungen." Poggend. Annal. 136. 70 and 235. 1869.
38. DUPRÉ AND PAGE.—"On the specific heat and other physical characters of mixtures of ethylic alcohol and water." Phil. Trans. 1869. 591.
39. WÜLLNER.—"Ueber die specifische Wärme von Salzlösungen und Flüssigkeitsgemischen." Poggend. Annal. 140. 479. 1870.
40. PFAUNDLER AND PLATTER.—"Ueber die Wärmecapacität des Wassers in der Nähe seines Dichtigkeitsmaximums." Poggend. Annal. 140, 574; and 141, 537. 1870
41. BUNSEN.—"Calorimetrische Untersuchungen." Poggend. Annal. 141. 1. 1870.
42. MARIGNAC.—"Resarches on the specific heats, densities, and expansions of some liquids." Phil. Mag. (4). 41. 134. 1871.
43. MIXTER AND DANA. "Specifische Wärme des Zirkoniums, Siliciums, und Bors." Ann. Chem. Pharm. 169. 388. 1873.
44. WINKELMANN.—"Ueber die Mischungswärme und specifische Wärme von Flüssigkeitsgemischen." Poggend. Annal. 150. 592. 1873.
45. WEBER.—"The specific heat of the elements Carbon, Boron, and Silicon." Phil. Mag. (4). 49. 161 and 276. 1875.
46. SCHÜLLER AND V. WARTHA.—"Ueber das Bunsen'sche Eis calorimeter." Ber. d. Deutsch. Chem. Gesellschaft. 8. 1011. 1875.

EXPLANATORY NOTES.

To the following tables a few, and only a few, notes of explanation are needed, referring chiefly to abbreviations.

The letter S. affixed to the name of any substance, or to a determination of specific heat, indicates that the substance was in the *solid* condition. The letter L., on the other hand, stands for *liquid*. These signs are used only when for any given substance determinations have been made both in the solid and liquid states.

When figures indicating any given temperature are appended to a determination of specific heat, they show that the determination applied only to that temperature. When, however, two temperatures are given, as for instance, .0557, 0°–100°, the determination is the mean specific heat between them as extremes.

Such an abbreviation as *m. of 2*, *m. of 5*, attached to any determination, indicates that it is a *mean of 2*, *mean of 5*, &c., experiments.

In referring to authorities more extended abbreviations have to be employed. A single number attached to the name of any authority, refers to the accompanying list of papers. Thus, Kopp. 34, refers to Kopp's paper numbered 34, and so on.

With other abbreviations, as a rule, which refer to periodicals or large works, numbers indicating series, volume, and page are also used. Of course when no number for series is given, the first (or perhaps only) series is referred to. The following abbreviations are employed:—

A. C. P. "Annalen der Chemie und Pharmacie."

A. C. Phys. "Annales de Chimie et de Physique."

A. S. P. N. "Annales des Sciences Physiques et Naturelles."

C. R. "Comptes Rendus."

C. S. J. "Journal of the Chemical Society."

Ed. J. S. "Edinburgh Journal of Science."

Fortsch. D. Phys. "Fortschritte der Physik."

Gilb. Ann. "Gilbert's Annalen."

Gm. H. Gmelin's "Handbook." Edition of the Cavendish Society, vol. 1, article on Specific Heat. (Hermann's paper, frequently referred to under this heading, was originally published in Moscow; the work containing it was not accessible to the compiler.)

J. "Jahresbericht für Chemie."

P. A. "Poggendorf's Annalen."

Watt's Dict. "Watt's Dictionary."

Wien Ak. "Sitzungsberichte der Akademie zu Wien."

A TABLE OF SPECIFIC HEAT, FOR SOLIDS AND LIQUIDS.

I. ELEMENTARY SUBSTANCES.

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Hydrogen.	1.			
Fluorine.	19.			
Chlorine.	35.5			
Bromine.	L. 80.0	.135.	10.80	Delarive & Marcet. 10.
"	"	.1071.	8.57	Andrews. P. A. 75. 335.
"	"	.11094.	8.87	{ Regnault. 18.
"	"	.11294.	9.03	
"	"	.10513.	8.41	
"	"	.1125. 18°-43.°6.	9.00	Marignac. A. C. Phys.
"	S.	.08432.	6.75	Regnault. 18. [6. 78.
Iodine.	L. 127.	.10822.	13.74	Favre & Silbermann. J.
"	S.	.082.		Avogadro. 7.
"	"	.05412.	6.87	Regnault. 8.
Lithium.	7.	.9408.	6.59	Regnault. 26.
Sodium.	23.	.2934.	6.75	" 25.
Potassium.	39.1			
Rubidium.	85.4			
Caesium.	133.0			
Silver.	108.0	.0557, 0°-100.°	6.02	{ Dulong & Petit. 1.
"		.0611, 0°-300.°	6.60	
"		.063.	6.80	Potter. Ed. J. S. 5. 80.
"		.05701.	6.16	Regnault. 8.
"		.05433, 5°-10.°	5.87	{ Regnault.* 13.
"		.05458, 10°-15.°	5.89	
"		.05424, 15°-20.°	5.86	
"		.05611, 5°-10.°	6.06	
"		.05612, 10°-15.°	6.06	
"		.05620, 15°-20.°	6.07	{
"		.05698, 0.°	6.15	
"		.05715, 50.°	6.17	
"		.05749, 100.°	6.21	
"		.05800, 150.°	6.26	
"		.05868, 200.°	6.34	{
"		.05953, 250.°	6.43	
"		.06055, 300.°	6.54	Byström. Fortsch. d. Phys. 16. 370.

*In the same paper are many determinations for *precipitated silver*.

SPECIFIC HEAT TABLES.

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Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Silver		.0560.	6.05	Kopp. 34.
"		.0559.	6.04	Bunsen. 41.
"		.05494.	5.93	Mixter & Dana. 43.
Thallium.	204.	.03250.	6.63	Lamy. Watts' Dict. 3.30.
"		.03355.	6.84	Regnault. 27.
Oxygen.	16.			
Sulphur. Liquid.	32.	.2337, 119°-146°	7.48	Person. P. A. 74. 509.
" Solid.		.1900.	6.08	Dalton. Gm. H. I.
" "		.1880. [Sulphur.	6.02	Dulong & Petit. 2.
" "		.209. Flowers of	6.69	Neumann. 4.
" "		.20259.	6.49	Regnault. 8.
" "		.1776. Native cryst. }	5.68	{ Regnault. 13.
" "		.1764. Fused since 2 ys. }	5.64	
" "		.1803. " " 2 ms. }	5.77	
" "		.1844. Lately fused. }	5.90	
" "		.235, 120°-147°	7.52	Person. 15.
" "		.163, 17°-45° Rhomb.	5.22	Kopp. 34.
" "		.1712. Roll Brimstone.	5.48	Bunsen. 41.
Selenium.	79.5	.0675.	5.37	Hermann. Gm. H. I.
"		.0834, 5°-15°	6.63	Delarive & Marcet. 10.
"		.07446. Metallic. }	5.92	{ Regnault. 25.
"		.07468. Vitreous. }	5.94	
"		.0860, m. of 13. Cryst.	6.84	Neumann. 33.
"		.08404. } Cryst.	6.68	{ [ner. 36. Bettendorf & Wüll-
"		.08399. } 2 Samples.	6.68	
"		.0953. Amorphous. }	7.58	
Tellurium.	129.	.0912.		Dulong & Petit. 2.
"		.05155.	6.65.	Regnault. 8.
"		.05165. Undist'd. }	6.66.	{ Regnault. 25.
"		.04737. Distilled. }	6.11.	
"		.0475.	6.13.	Kopp. 34.
Calcium.	40.	.1686. }	6.74.	{ Bunsen. 41.
"		.1722. }	6.88.	
Strontium.	87.5			
Barium.	137.0			
Lead. Melted.	207.0	.039, 340°-440°	8.07.	Person. 15.
" "		.0402.	8.32.	Person. P. A. 76. 426.
" Solid.		.0400.		Dalton. Gm. H. I.
" "		.0293.	6.07.	Dulong & Petit. 2.
" "		.032.	6.62.	Potter. Ed. J. S. 5. 80.
" "		.0299.	6.19.	Hermann. Gm. H. 1.
" "		.03140, 10°-100°	6.50.	Regnault. 8.
" "		.03065, -77°75' to +10°	6.34.	Regnault. 18. [38. 39.
" "		.0321.	6.64.	Schnidaritsch. Wien A.
" "		.03050, 14°-108° }	6.31.	{ Bede. Fortsch. d. Phys. 11. 379.
" "		.03170, 16°-172° }	6.56.	

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Lead. Solid.		.0315.	6.52.	Kopp. 34.
Chromium.	52.5			Regnault. 8.
Manganese.	55.	.14411. Very impure		{ Regnault. 26.
"		.1332. } 2 samples.	6.69.	[Ann. 5. 42.
"		.1217. }	7.11.	Crawford. See Gilb.
Iron.	56.	.1269.	7.28.	Dalton. Gm. H. I.
"		.1300.	6.15.	{
"		.1098, 0°-100.°	6.44.	{ Dulong & Petit. 1.
"		.1150, 0°-200.°	6.82.	{
"		.1218, 0°-300.°	7.03.	{
"		.1255, 0°-350.°	6.16.	{ Potter. Ed. J. S. 5. 80.
"		.110.	5.90.	{ Hermann. Gm. H. I.
"		.1054.	6.37.	{ Regnault. 8. Ak. 38. 39.
"		.11379.	6.33.	{ Schnidaritsch. Wien
"		.1131.	6.29.	{ Bede.
"		.1123, 15°-100.°	6.46.	{ Fortsch. d. Phys.
"		.11533, 16°-142.°	6.91.	{ 11. 379.
"		.12331, 20°-247.°	6.25.	{
"		.111641, 0.°	6.29.	{
"		.112369, 50.°	6.37.	{ Byström.
"		.113795, 100.°	6.49.	{ Fortsch. d. Phys.
"		.115949, 150.°	6.65.	{ 16. 370.
"		.118821, 200.°	6.85.	{
"		.122411, 250.°	7.10.	{
"		.126719, 300.°	6.27.	{ Kopp. 34.
"		.112.	6.30.	{ Weber. P. A. 146. 257.
"		.1125.	6.37.	{
"		.1138. }	6.45.	{
"		.1151. } 99°1.	6.27.	{
"		.1120. }	6.26.	{
"		.1118. 235°2.	6.31.	{
"		.1126. 247°2.	6.31.	{ Weinhold.
"		.1126. 248°1.	6.99.	{ P. A. 149. 186.
"		.1248. 475.°	7.06.	{
"		.1261. 490.°	7.19.	{
"		.1284. 522.°	7.88.	{
"		.1407. 697.°	7.96.	{
"		.1422. 736.°	8.79.	{
"		.1570. 874.°	8.77.	{ [50. 555.
"		.1567. 900.°	8.79.	{ W. C. Roberts, P. M. 4.
Cast Iron.		.15693, 0°-1040.°		Regnault. 8.
" "		.12728.		{ Byström.
" "		.12768, 0.°		{ Fortsch. d. Phys.
" "		.12830, 50.°		{ 16. 370.
" "		.12954, 100.°		{

SPECIFIC HEAT TABLES.

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Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Cast Iron.		.13140, 150.°		
" "		.13388, 200.°		
" "		.13698, 250.°		Byström. Fortsch. d. Phys. 16. 370.
" "		.14070, 300.°		
White Cast Iron.		.12983.		Regnault. 8.
Steel.		.11848.		Regnault. 8.
"		.1165. Soft.		
"		.1175. Hard.		Regnault. 13.
"		.11782, 0.°		
"		.11850, 50.°		
"		.11986, 100.°		
"		.12190, 150.°		Byström. Fortsch. d. Phys. 16. 370.
"		.12462, 200.°		
"		.12802, 250.°		
"		.1321, 300.°		
Nickel.	58.7	.1035.	6.07	Dulong & Petit. 2.
"		.10863.	6.38	
"		.11192. Unfused		Regnault. 8.
"		.11631. Cast } contain Carbon.		
"		.11095.	6.51	Regnault. 25.
"		.10752.	6.31	Regnault. 26.
"		.1108. }	6.50	
Cobalt.	58.7	.1498.		Dulong & Petit. 2.
"		.10696. [Carbon.]	6.28	Regnault. 8.
"		.11712. Cast. Contains		
"		.1172, 5°-15.°	6.88	Delarive & Marcet. 10.
"		.10094. }	5.93	
"		.10620. }	6.23	Regnault. 26.
"		.10727. }	6.30	
Uranium.	120.	.06190.	7.43	Regnault. 8.
Copper.	63.5	.0949, 0°-100.°	6.03	Dulong & Petit. 1.
"		.1013, 0°-300.°	6.43	
"		.096.	6.10	Potter. Ed. J. S. 5. 80.
"		.0961.	6.10	Hermann. Gm. H. I.
"		.09515.	6.04	Regnault. 8.
"		.095, 5°-15.°	6.03	Delarive & Marcet. 10.
"		.08842, 5°-10.°		
"		.08913, 10°-15.°		Regnault. 13.
"		.08847, 15°-20.°		
"		.09331, 15°-100.°	5.93	
"		.09483, 16°-172.°	6.02	Bede. Fortsch. d. Phys. 11. 379.
"		.09680, 17°-247.°	6.15	
"		.0951.	6.04	Pape. 29.
"		.0930.	5.90	Kopp. 34.
Ruthenium.	104.4	.0611.	6.38	Bunsen. 41.
Rhodium.	104.4	.05527. }	5.77	Regnault. 26.
"		.05803. } 2 Samples.	6.07	

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Rhodium.		.05408, m. of 3.	5.64	Regnault. 25.
Palladium.	106.6	.05927.	6.32	Regnault. 8.
"		.05921.	6.31	{ Roberts & Wright. C. S. J. (2). 11. 117. See this paper for full details concerning palladium with occluded hydrogen
"		.06007. } 15°-100.°	6.40	
"		.06022. }	6.42	
"		.05918, -10° to +15°	6.31	
Platinum.	197.5	.0355, 0°-100.°	7.01	{ Dulong & Petit. 1.
"		.0355, 0°-300.°	7.01	
"		.0314.	6.20	Dulong & Petit. 2.
"		.03243. Rolled. }	6.40	{ Regnault. 8.
"		.03293. Spongy. }	6.50	
"		.03509, 5°-10.°	6.93	{ Regnault. 13.
"		.03449, 10°-15.°	6.81	
"		.03509, 15°-20.°	6.93	{ Pouillet. See Bal- four Stewart's "Ele- mentary Treatise on Heat." P. 268.
"		.0335, 0°-100.°	6.62	
"		.0343, 0°-300.°	6.77	
"		.0352, 0°-500.°	6.95	
"		.0360, 0°-700.°	7.11	
"		.0373, 0°-1000.°	7.37	
"		.0382, 0°-1200.°	7.54	
"		.032386, 0.°	6.39	
"		.032480, 50.°	6.41	
"		.032668, 100.°	6.45	
"		.032950, 150.°	6.51	{ Byström. Fortsch. d Phys. 16. 370.
"		.033326, 200.°	6.58	
"		.033796, 250.°	6.67	{ Kopp. 34.
"		.034750, 300.°	6.86	
"		.0325.	6.42	{ Weinhold. P. A. 149. 186.
"		.03290. }	6.49	
"		.03270. } 99°1.	6.46	
"		.03297. }	6.51	
"		.03508. 238°5.	6.93	
"		.03520. 246°4.	6.95	
"		.03411. 256°8.	6.74	
"		.03188. 476.°	6.30	
"		.03230. 478.°	6.38	
"		.03253. 507.°	6.42	
"		.03333. 705.°	6.58	{ Regnault. 8.
"		.03381. 766.°	6.68	
"		.03396. 934.°	6.71	{ Regnault. 25.
"		.03333. 952.°	6.58	
Iridium.	198.	.03683. Very impure		Regnault. 26.
"		.0363.	7.19	Regnault. 25.
"		.04186. }	{ Regnault. 26.	
"		.03259. } 2 samples.	6.45	

SPECIFIC HEAT TABLES.

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Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Osmium.	199.2.	.03063, m. of 3.	6.10.	Regnault. 25.
"		.03063.	6.10.	{ Regnault. 26.
"		.03113. } 2 samples.	6.20.	
Molybdenum.	95.9.	.07218.	6.92.	Regnault. 8.
"		.0659, 5°-15°	6.32.	Delarive & Marcet. 10.
Tungsten.	184.	.03636.	6.69.	Regnault. 8.
"		.035, 6°25'-15°.	6.44.	Delarive & Marcet. 10.
"		.03342.	6.15.	Regnault. 26.
Indium.	113.4.	.0565. }	6.40.	{ Bunsen. 41.
"		.0574. }	6.51.	
Zinc.	65.2.	.1000.	6.52.	Dalton. Gm. H. I.
"		.0927, 0°-100.° }	6.04.	{ Dulong & Petit. 1.
"		.1015, 0°-300.° }	6.62.	
"		.0929.	6.06.	Neumann. 4.
"		.098.	6.40.	Potter. Ed. J. S. 5. 80.
"		.09555.	6.23.	Regnault. 8.
"		.09142, 5°-10.° }	5.96.	{
"		.09252, 10°-15.° }	6.03.	{ Regnault. 13.
"		.09123, 15°-20.° }	5.95.	{ Ak. 38. 39.
"		.0924.	6.02.	Schnidaritsch. Wien
"		.09088, 16°-101.° }	5.93.	{
"		.09385, 17°-172.° }	6.12.	{ Bede. Fortsch. d.
"		.09563, 17°-213.° }	6.23.	{ Phys. 11. 379.
"		.0932.	6.08.	Kopp. 34.
"		.0935.	6.10.	Bunsen. 41. [46.
" Distilled.		.09393.	6.12.	Schüller & V. Wartha.
Cadmium.	112.	.0385.		Hermann. Gm. H. I.
"		.05669.	6.35.	Regnault. 8.
"		.0576, 5°-15.°	6.45.	Delarive & Marcet. 10.
"		.05908, 5°-10.° }	6.62.	{
"		.05969, 10°-15.° }	6.68.	{ Regnault. 13.
"		.05938, 15°-20.° }	6.65.	{
"		.0542.	6.07.	Kopp. 34.
"		.0548.	6.14.	Bunsen. 41.
Magnesium.	24.	.2499.	6.00.	Regnault. 26.
"		.245.	5.88.	Kopp. 34.
Mercury.	200.	.0330.	6.60.	Kirwan. Gm. H. I.
"		.0330, 0°-100.° }	6.60.	{
"		.0350, 0°-300.° }	7.70.	{ Dulong and Petit. 1.
"		.03332, 10°-100.°	6.64.	Regnault. 8.
"		.0318.	6.36.	Delarive & Marcet. 10.
"		.0282, 5°-10.° }		{
"		.0283, 10°-15.° }		{ Regnault. 13.
"		.0290, 15°-20.° }		{
"		.0332, 24°-44.°	6.64.	Kopp. 16.
"		.0335, m. of 5.	7.37.	Kopp. 34.

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Mercury. Solid.		.03192, -77°75 to -40°	6.38.	Regnault. 18.
Nitrogen.	14.			
Boron. Amorphous	11.	.3598. }	3.96.	{ Regnault. 26.
" "		.3483. }	3.83.	
" "		.4053. }	4.46.	
" "		.254.	2.79.	Kopp. 34.
" Graphitoidal.		.2352.	2.59.	Regnault. 26.
" Crystalline.		.2622. }	2.88.	{ Regnault. 26.
" "		.2253. }	2.48.	
" "		.2574. }	2.83.	
" "		.230.	2.53.	Kopp. 34.
" "		.2518.	2.77.	Mixter & Dana. 43.
" "		.1915, -39°6. }	2.11.	{ F. Weber. P. M. (4)
" "		.2382, +26°6. }	2.72.	
" "		.2737, 76°7. }	3.01.	
" "		.3069, 125°8. }	3.38.	
" "		.3378, 177°2. }	3.72.	
" "		.3663, 233°2. }	4.03.	
Phosphorus.	31.	.196, 50°-100.° Melted	6.08.	Desains. P. A. 70. 315.
" "		.2045. "	6.34.	Person. P. A. 74. 509.
" Common.		.2900.		Hermann. Gm. H. I.
" "		.385.		Avogadro. 7.
" "		.1887, 10°-30.° }	5.85.	{ Regnault. 8.
" "		.25142, 0°-100.° }		
" "		.212, 50°-100.° }	6.57.	Person. 15.
" "		.2000, 25°-50.° }	6.20.	Desains. P. A. 70. 315.
" "		.1788, -21° to +7.° }	5.54.	Person. P. A. 74. 509.
" "		.1740, -77°75 to +10° }	5.39.	{ Regnault. 18.
" "		.1887, 10°-30.° }	5.85.	
" "		.202, 13°-36.° }	6.26.	Kopp. 34.
" Red.		.16981.	5.26.	Regnault. 23.
Arsenic.	75.	.0804.	6.03.	Hermann. Gm. H. I.
" "		.081.	6.07.	Avogadro. 7.
" "		.08140.	6.10.	Regnault. 8.
" "		.09006, 5°-10.° }	6.75.	{ Regnault. 13.
" "		.09085, 10°-15.° }	6.81.	
" "		.09019, 15°-20.° }	6.76.	
" "		.0822, m. of 6.	6.16.	Neumann. 33.
" "		.0830. Crystalline. }	6.22.	{ Bettendorf & Wüll-
" "		.0758. Amorphous }	5.68.	
Antimony.	122.	.0507, 0°-100.° }	6.19.	{ Dulong & Petit. 1.
" "		.0549, 0°-300.° }	6.69.	
" "		.047.	5.73.	Neumann. 4.
" "		.0496.	6.05.	Hermann. Gm. H. I.
" "		.05077.	6.19.	Regnault. 8.

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Antimony.		.06305, 5°-10.°		{ Regnault. 13.
"		.06367, 10°-15.°		
"		.06424, 15°-20.°		{ Bede. Fortsch. d. Phys. 11. 379.
"		.04861, 13°-106.°	5.93	
"		.04989, 15°-175.°	6.09	{ Kopp. 34.
"		.05073, 12°-209.°	6.19	
"		.0523.	6.38	{ Bunsen. 1.
"		.0495.	6.04	
Bismuth. Melted.	210.	.035, 280°-370.°	7.35	Person. 15.
" " Solid.		.0363.	7.62	Person. P. A. 76. 426.
"		.0288.	6.05	Dulong & Petit. 2.
"		.027.	5.67	Neumann. 4.
"		.039.		Potter. Ed. J. S. 5. 80.
"		.03084.	6.48	Regnault. 8.
"		.03732, 5°-10.°		{ Regnault. 13.
"		.03788, 10°-15.°		
"		.03639, 15°-20.°		{ Schnidaritsch. Wien. Ak. 33. 39.
"		.0309.	6.49	
"		.02889, 13°-106.°	6.07	{ Bede. Fortsch. d. Phys. 11. 379.
"		.03036, 15°-175.°	6.38	
"		.03085, 13°-205.°	6.48	{ Kopp. 34.
"		.02979, 9°-102.° Pu- [refined.]	6.26	
"		.0305.	6.40	
Vanadium.	51.5			
Gold.	197.	.0298.	5.47	Dulong & Petit. 2.
"		.046.		Potter. Ed. J. S. 5. 80.
"		.03294.	6.49	Regnault. 8.
Carbon. Diamond.	12.	.1192, 3°-11.°	1.43	Delarive & Marcet. 10.
"		.14687.	1.76	Regnault. 11. [36.
"		.1483, m. of 6.	1.78	Bettendorf & Wüllner.
"		.1434. } 0°-100.°	1.72	{ Weber. P. A. 147.
"		.1439. }	1.73	
"		.0947, 0.°	1.14	{ 311.
"		.1435, 50.°	1.72	
"		.1905, 100.°	2.29	{ Weber. C. S. J. (2).
"		.2357, 150.°	2.83	
"		.2791. 250.°	3.35	{ 12. 224.
"		.10, 0.°	1.20	
"		.28, 300.°	3.36	{ F. Weber. P. M. (4).
"		.0635, — 50°5.	0.76	
"		.0955, — 10°6.	1.15	{ 49. 161.
"		.1128, + 10°7	1.35	
"		.1318, 33°4.	1.58	
"		.1532, 58°3.	1.84	
"		.1765, 85°5.	2.12	

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Carbon. Diamond.		.2218, 140. ^o	2.66	{ F. Weber. P. M. (4). 49. 161.
" "		.2733, 206 ^o 1.	3.28	
" "		.3026, 247. ^o	3.63	
" "		.4408, 606 ^o 7.	5.29	
" "		.4489, 806 ^o 5.	5.39	
" "		.4589, 985. ^o	5.51	{ Regnault. 11.
" Graphite.		.20187. Natural.	2.42	
" "		.19702. From iron.	2.36	
" "		.174. Natural.	2.09	
" "		.166. From iron.	1.99	
" "		.1911. } Extremes of 5 det. from different samples.	2.29	{ Regnault. J. 19. 22.
" "		.2019. }	2.42	
" "		.1955. Natural.	2.35	{ Bettendorf & Wüll- ner. 86.
" "		.1961. From iron.	2.35	
" "		.1439, 0 ^o -34. ^o	1.73	{ Weber. P. A. 147. 311.
" "		.1967, 0 ^o -100. ^o	2.36	
" "		.17, 0. ^o	2.04	{ Weber. C. S. J. (2). 12. 224.
" "		.35, 300. ^o	4.20	
" "		.1138, — 50 ^o 3. }	1.37	{ F. Weber. P. M. (4). 49. 276.
" "		.1437, — 10 ^o 7. }	1.72	
" "		.1604, + 10 ^o 8. }	1.92	
" "		.1990, 61 ^o 3. }	2.39	
" "		.2542, 138 ^o 5. }	3.05	
" "		.2966, 201 ^o 6. }	3.56	
" "		.3250, 249 ^o 3. }	3.90	
" "		.4454, 641 ^o 9. }	5.34	
" "		.4539, 822. ^o	5.46	
" "		.4670, 977 ^o 9. }	5.60	
" Charcoal.		.25.	3.00	
" "		.24111.	2.89	
" "		.24150.	2.90	
" "		.165, 6 ^o 25-15. ^o	1.98	
" "		.1592. From sugar.	1.91	
" "		.1801. " turpentine	2.16	
" "		.2009, Popl'r quench'd	2.41	
" "		.2964, " unquench'd	3.56	
" "		.1653, 0 ^o -23 ^o 5. }	1.98	
" "		.1935, 0 ^o -99 ^o 22. }	2.32	
" "		.2385, 0 ^o -223 ^o 6. }	2.86	
" Animal C.		.257.	3.08	Avogadro. 6.
" "		.26085.	3.13	Regnault. 11.
" Anthracite		.20171. Welsh. }		{ Regnault. 11.
" "		.20100. Penn'a. }		
" { Amorphous from lime- stone.		.1906, 0 ^o -99. ^o	2.29	{ F. Weber. P. M. (4). 49. 276.
" "		.2348, 0 ^o -225 ^o 6. }	2.82	
" Coke.		.20307. From cannel.	2.44	Regnault. 11.

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Carbon. Coke.		.20085. From anthracite	2.41	Regnault. ' 11.
" Gas Carbon.		.20360.	2.44	Regnault. 11. .
" " "		.185.	2.22	Kopp. 34. [36.
" " "		.204, m. of 8.	2.45	Bettendorf & Wüllner.
" In general.		.32, 20°-1040.°	3.84	{ Dewar. C. S. J. (2).
" " "		.42, 2100°	5.04	{ 11. 239.
Silicon. Cast.	28	.1557. } Early det.	4.36	{
" " "		.1630. }	4.56	{ Regnault. 26.
" " "		.1747. }	4.89	{
" " "		.1750. Latest det. }	4.90	{
" " "		.138.	3.86	Kopp. 34.
" Graphitic.		.181.	5.07	Kopp. 34.
" Cryst.		.1673. }	4.68	{
" " "		.1762. }	4.93	{ Regnault. 26.
" " "		.1742. }	4.88	{
" " "		.1787. }	5.03	{
" " "		.165.	4.62	Kopp. 34.
" " "		.16995. }	4.76	{
" " "		.1704. }	4.77	{ Mixter & Dana. 43.
" " "		.1360, - 39°8.	3.81	{
" " "		.1697, + 21°6.	4.75	{
" " "		.1833, 57°1.	5.13	{
" " "		.1901, 86°0.	5.32	{ F. Weber. P. M. (4).
" " "		.1964, 128°7.	5.50	{ 49. 294.
" " "		.2011, 184°3.	5.63	{
" " "		.2029, 232°4.	5.68	{
Titanium.	50.			[Ann. 5. 42.
Tin.	118.	.0704.		Crawford. See Gilb.
"		.0700.		Dalton. Gm. H. I.
"		.0514.	6.06	Dulong & Petit. 2.
"		.056.	6.61	Potter. Ed. J. S. 5. 80.
"		.05623. Banca. }	6.63	{
"		.05965. English. }	6.72	{ Regnault. 8.
"		.0514, 5°-15.°	6.06	Delarive & Marcet. 10.
"		.05477, 5°-10.°	6.46	{
"		.05546, 10°-15.°	6.54	{
"		.05504, 15°-20.°	6.49	{ Regnault. 13.
"		.05651, 5°-10.°	6.67	{
"		.05614, 10°-15.°	6.62	{
"		.05662, 15°-20.°	6.68	{ [Ak. 38. 39.
"		.0533.	6.29	Schnidaritsch. Wien
"		.05445, 15°-100.°	6.43	{
"		.05753, 15°-172.°	6.79	{ Bede. Fortsch. d.
"		.05832, 16°-213.°	6.88	{ Phys. 11. 379.
"		.0548.	6.47	Kopp. 34.
"		.0545. Allotropic.	6.43	Bunsen. 41.

Name.	Atomic Weight	Specific Heat.	Atomic Heat.	Authority.
Tin.		.0559. Cast.	6.60	Bunsen. 41.
" Melted.		.061, 240°-340°	7.20	Person. 15.
" "		.0637.	7.52	Person. P. A. 76. 426.
Zirconium.	89.6	.06666.	5.97	Mixter & Dana. 43.
Thorium.	234.			
Lanthanum.	92.			
Didymium.	96.			
Cerium.	92.	.05.	?	Schuchardt.*
Yttrium.	59.7.			
Erbium.	113.7.			
Glucinum.	9.3			
Aluminum.	27.4.	.21224.	5.82.	Regnault. 25.
"		.2020.	5.53.	Kopp. 34.
Niobium.	94.			
Tantalum.	172.			

* Quoted by Mendeleeff. A. C. P. 8th Supplement. 189.

SPECIFIC HEAT TABLES.



II. INORGANIC FLUORIDES, CHLORIDES, BROMIDES, AND IODIDES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium fluoride	Na F.	.2678.	11.25	Hermann.Gm.H.I
Calcium "	Ca F ₂ .	.1912.	14.91	Hermann.Gm.H.I
" "	"	.2082.	16.24	Neumann. 4.
" "	"	.21492.	16.76	Regnault. 11.
" "	"	.209.	16.30	Kopp. 34.
Cryolite.	3 Na F. Al F ₃ .	.238.	50.07	Kopp. 34.
Lithium chloride	Li Cl.	.2650.	11.26	Hermann.Gm.H.I
" "	"	.28213.	11.99	Regnault. 25.
Sodium "	Na Cl.	.226.	13.22	Gadolin. See 6.
" "	"	.2300.	13.45	Dalton. Gm. H. I.
" "	"	.1817.		Hermann.Gm.H.I
" "	"	.221.	12.93	Avogadro. 6. [474.
" "	"	.1743.		Rudberg. P.A. 35.
" "	"	.21401.	12.52	Regnault. 11.
" "	"	.2070.	12.11	Neumann. 33.
" "	"	.213. Fused.	12.46	{ Kopp. 34.
" "	"	.219. Rock salt.		
Potassium "	K Cl.	.1403.	12.81	Hermann.Gm.H.I
" "	"	.184.	13.71	Avogadro. 6.
" "	"	.17295.	12.88	Regnault. 11.
" "	"	.1663.	12.39	Neumann. 33.
" "	"	.171.	12.74	Kopp 34.
Rubidium "	Rb Cl.	.112.	13.54	Kopp. 34.
Ammonium "	NH ₄ Cl.	.3908.	20.91	Neumann. 33.
" "	"	.373. Crystallized.	19.96	Kopp. 34.
Silver "	Ag Cl.	.0844.	12.11	Hermann.Gm.H.I
" "	"	.09109.	13.07	Regnault. 11.
" "	"	.0894.	12.83	Neumann. 33.
Sulphur chloride	S ₂ Cl ₂ .	.2048, 5°-10°		{ Regnault. 13.
" "	"	.2024, 10°-15°		
" "	"	.2038, 15°-20°		
Calcium "	Ca Cl ₂ .	.1102.		Hermann.Gm.H.I
" "	"	.194.	21.53	Avogadro. 6.
" "	"	.16420.	18.23	Regnault. 11.
" "	Ca Cl ₂ . 6 H ₂ O.	.406, -40° to -2.°	88.91	{ Person. 15.
" "	"	.647, 4°-28.°	141.69	
" "	"	.358, 31°-60.°	78.40	
" "	"	.628, 60°-100.°	137.53	
" "	"	.519, 100°-127.°	113.66	

Name.	Formula.	Specific Heat.	Molec. Heat.	Authority.
Strontium chloride.	Sr Cl ₂ .	.0972.		Hermann.Gm.H.I
" "	"	.11990.	19.00	Regnault. 11.
Barium chloride	Ba Cl ₂ .	.0780.		Hermann.Gm.H.I
" "	"	.08957.	18.63	Regnault. 11.
" "	"	.0902.	18.76	Kopp. 34.
" "	Ba Cl ₂ . 2 H ₂ O.	.171. Crystals.	41.72	" "
Lead	Pb Cl ₂ .	.06641.	18.46	Regnault. 11.
" "	"	.0692.	19.24	Neumann. 33.
Chromium "	Cr ₂ Cl ₆ .	.143. Crystallized.	45.47	Kopp. 34.
Manganese "	Mn Cl ₂ .	.14255.	17.96	Regnault. 11.
Cuprous "	Cu Cl.	.13827.	13.69	" "
Zinc "	Zn Cl ₂ .	.13618.	18.55	" "
Magnesium "	Mg Cl ₂ .	.19460.	18.39	" "
" "	"	.191.	18.14	Kopp. 34.
Mercurous "	Hg Cl.	.0495.		Hermann.Gm.H.I
" "	"	.041.		Avogadro. 6.
" "	"	.05205.	12.26	Regnault. 11.
Mercuric "	Hg Cl ₂ .	.0715.		Hermann.Gm.H.I
" "	"	.069.	18.70	Avogadro. 6.
" "	"	.06889.	18.67	Regnault. 11.
" "	"	.064. Crystallized.	17.34	Kopp. 34.
Phosphorus tri-chloride.	P Cl ₃ .	.20922.	28.07	Regnault. 11.
" "	"	.2017, 5°-10.°	27.73	{ Regnault. 13.
" "	"	.1987, 10°-15.°	27.32	
" "	"	.1991, 15°-20.°	27.35	
Arsenic "	As Cl ₃ .	.17604.	31.95	Regnault. 11.
Carbon "	C ₂ Cl ₆ .	.178, 18°-37.°	42.19	Kopp. 34.
" tetra-chloride.	C Cl ₄ .	.207202, 30.°	31.91	{ Hirn. J. 20. 56.
" "	"	.2095947, 40.°	32.28	
" "	"	.211533, 50.°	32.58	
" "	"	.2133591, 60.°	32.88	
" "	"	.2149066, 70.°	33.10	
" "	"	.2162598, 80.°	33.30	
" "	"	.2177109, 90.°	33.53	
" "	"	.2195151, 100.°	33.81	
" "	"	.220726, 110.°	33.99	
" "	"	.221828, 120.°	34.17	
" "	"	.2236305, 130.°	34.44	
" "	"	.2260645, 140.°	34.91	
" "	"	.2291237, 150.°	35.28	
" "	"	.2327877, 160.°	35.85	
Silicon "	Si Cl ₄ .	.1914, 5°-10.°	32.54	{ Regnault. 13.
" "	"	.1904, 10°-15.°	32.37	
" "	"	.1904, 15°-20.°	32.37	

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Titanium tetra-chloride.	Ti Cl ₄ .	.19145.	36.76	Regnault. 11.
" "	"	.1810, 5°-10.°	34.75	{ Regnault. 18.
" "	"	.1802, 10°-15.°	34.60	
" "	"	.1828, 15°-20.°	35.10	
Tin "	Sn Cl ₄ .	.14759.	38.37	Regnault. 11.
" "	"	.1421, 5°-10.°	36.95	{ Regnault. 18.
" "	"	.1402, 10°-15.°	36.45	
" "	"	.1416, 15°-20.°	36.82	
" dichloride.	Sn Cl ₂ .	.10161.	19.20	Regnault. 11.
Zinc potassium chloride.	Zn Cl ₂ . 2 K Cl.	.152. Crystallized.	43.38	Kopp. 34.
Tin potassium chloride.	Sn Cl ₂ . 2 K Cl.	.133. "	44.98	" "
Potassium platinchloride.	Pt Cl ₄ . 2 K Cl.	.113. "	55.22	" "
Sodium bromide.	Na Br.	.13842.	14.26	Regnault. 11.
Potassium "	K Br.	.11322.	13.47	" "
Silver "	Ag Br.	.07391.	13.90	" "
Lead "	Pb Br ₂ .	.05326.	19.55	" "
Sodium iodide.	Na I.	.08684.	13.03	Regnault. 11.
" "	"	.0881.	13.21	Schüller. 37.
Potassium "	K I.	.0657.		Hermann.Gm.H.I
" "	"	.08191.	13.60	Regnault. 11.
Silver "	Ag I.	.06159.	14.47	" "
Lead "	Pb I ₂ .	.04267.	19.67	" "
Cuprous "	Cu I.	.06869.	13.09	" "
Mercurous "	Hg I.	.03949.	12.91	" "
Mercuric "	Hg I ₂ .	.04197.	19.05	" "

III. INORGANIC OXIDES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Water.	H ₂ O.	1.0, 0°-1.°	18.00	Standard of comparison with Bosscha. P. A. Jubelband. 1874. p. 549. Regnault. 19. For other series of determinations for water, see Hirn, C. R. 70.592; Jamin and Amaury, C. R. 70.661; and Pfannndler and Platter, P. A. 140.574, and P. A. 141.537.
"	"	1.0002, 0°-10.°	18.00	
"	"	1.0005, 0°-20.°	18.01	
"	"	1.0009, 0°-30.°	18.02	
"	"	1.0013, 0°-40.°	18.02	
"	"	1.0017, 0°-50.°	18.03	
"	"	1.0023, 0°-60.°	18.04	
"	"	1.0030, 0°-70.°	18.05	
"	"	1.0035, 0°-80.°	18.06	
"	"	1.0042, 0°-90.°	18.07	
"	"	1.0050, 0°-100.°	18.09	
"	"	1.0058, 0°-110.°	18.10	
"	"	1.0067, 0°-120.°	18.12	
"	"	1.0076, 0°-130.°	18.14	
"	"	1.0087, 0°-140.°	18.16	
"	"	1.0097, 0°-150.°	18.17	
"	"	1.0109, 0°-160.°	18.20	
"	"	1.0121, 0°-170.°	18.22	
"	"	1.0133, 0°-180.°	18.24	
"	"	1.0146, 0°-190.°	18.26	
"	"	1.0160, 0°-200.°	18.29	
"	"	1.0174, 0°-210.°	18.31	
"	"	1.0189, 0°-220.°	18.34	
"	"	1.0204, 0°-230.°	18.37	
Snow.	"	.5241.	9.43	Gadolin. See P. A. 90. 511.
Ice.	"	.513, m. of 5.	9.23	Desains. 14.
"	"	.56.	10.08	Person. P. A. 65. 439.
"	"	.505, -30° to 0°.	9.09	Person. 15.
"	"	.504.	9.07	Person. P. A. 74. 439.
"	"	.533.	9.59	Hess. Fortsch d. Phys. 6. 611.
Calcium oxide.	Ca O.	.217.	12.15	Lavoisier & Laplace. See 6.
"	"	.223.	12.49	Crawford. See 6.
"	"	.3000.		Dalton. Gm. H. I.
"	"	.179.	10.02	Avogadro. 6.
Lead	Pb O.	.049.	10.93	Gadolin. See 6.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Lead oxide.	Pb O.	.0544.	12.13	Hermann.Gm.H.I
" "	"	.050.	11.15	Avogadro. 6.
" "	"	.05118. Powder.	11.41	{ Regnault. 11.
" "	"	.05089. Fused.	11.35	
" "	"	.0553. Powder.	12.33	Kopp. 34.
Red lead.Minium	Pb ₂ O ₄ .	.062.	42.47	Lavoisier & Laplace.
" " "	"	.068.	46.58	Crawford & Kirwan.
" " "	"	.059.	40.41	Gadolin.
" " "	"	.0611.	41.85	Neumann. 4.
" " "	"	.072.	49.32	Avogadro. 6.
Chromic oxide.	Cr ₂ O ₃ .	.196.	29.99	Neumann. 4.
" "	"	.2126.	32.53	Hermann.Gm.H.I
" "	"	.17960.	27.47	Regnault. 11.
" "	"	.177. Crystalline.	27.08	Kopp. 34.
Manganese mon-oxide.	Mn O.	.15701.	11.15	Regnault. 11.
" dioxide.	Mn O ₂ .	.191. Pyrolusite.	16.62	Avogadro. 6.
" "	"	.159. "	13.83	Kopp. 34.
Mangano - man- ganic oxide.	Mn ₂ O ₄ .	.1651.	37.80	Hermann.Gm.H.I
Ferric oxide.	Fe ₂ O ₃ .	.2500.		Crawford. See Gilb. Ann. 5. 45.
" "	"	.167.	26.72	Gadolin. See 6.
" "	"	.1692. } Specular.	27.07	{ Neumann. 4.
" "	"	.163. } By two methods.	27.08	
" "	"	.166. Hematite.	26.56	
" "	"	.213.	34.08	Avogadro. 6.
" "	"	16695. Specular.	26.71	{ Regnault. 11.
" "	"	17569. } Colcothar. Four samples differently treated.	28.11	
" "	"	17167. }	27.46	
" "	"	16921. }	27.07	
" "	"	16814. }	26.90	
" "	"	.154. Specular.	24.64	Kopp. 34.
Ferroso-ferric oxide.	Fe ₃ O ₄ .	.1641.	38.07	Neumann. 4.
" " "	"	.16780. Magnetite.	38.93	Regnault. 11.
" " "	"	.156. "	36.19	Kopp. 34.
Nickel oxide.	Ni O.	.16234.	12.13	{ Regnault. 11.
" "	"	.15885. Ignited.	11.87	
Cuprous "	Cu ₂ O.	.1073. Cuprite.	15.34	Neumann. 4.
" "	"	.111. "	15.87	Kopp. 34.
Cupric "	Cu O.	.227.		Crawford. See 6.
" "	"	.137.	10.89	Neumann. 4.
" "	"	.146.	11.61	Avogadro. 6.
" "	"	.14201.	11.29	Regnault. 11.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Uranous oxide.	U O.	.106.	14.40	Neumann. 4.
" "	"	.0764.	10.39	Hermann.Gm.H.I
Pitchblende.	U ₃ O ₄ .	.1023. By mixture }	43.38	{ Neumann. 4.
"	"	.106. By cooling. }	44.94	
Zinc oxide.	Zn O.	.137.	11.12	Crawford. See 6.
" "	"	.132.	10.72	Neumann. 4.
" "	"	.1488.	12.08	Hermann.Gm.H.I
" "	"	.141.	11.45	Avogadro. 6.
" "	"	.12480.	10.13	Regnault. 11.
Magnesium "	Mg O.	.276.	11.04	Neumann. 4.
" "	"	.1696.		Hermann.Gm.H.I
" "	"	.24344.	9.74	Regnault. 11.
Mercuric "	Hg O.	.0501.	10.82	Lavoisier & Laplace. See 6.
" "	"	.049.	10.58	Neumann. 4.
" "	"	.050.	10.80	Avogadro. 6.
" "	"	.05179.	11.19	Regnault. 11.
" "	"	.0530. Crystalline.	11.45	Kopp. 34.
Molybdenum trioxide.	Mo O ₃ .	.13240.	19.05	Regnault. 11.
" "	"	.1634. } Too high?	23.51	{ Schafarik. Wien
" "	"	.1504. }	21.64	
" "	"	.154. (?) Powder.	22.16	Kopp. 34.
Tungsten	W O ₃ .	.0722.	16.75	Hermann.Gm.H.I
" "	"	.07983.	18.52	Regnault. 11.
" "	"	.0894. (?) Powder.	20.74	Kopp. 34.
Aluminum oxide	Al ₂ O ₃ .	.185.	19.01	Gadolin. See 6.
" "	"	.4963. Artificial.	20.18	Hermann.Gm.H.I
" "	"	.1942. Corundum. }	19.96	{ Neumann. 4.
" "	"	.1972. Sapphire. }	20.27	
" "	"	.200. Precipitated.	20.56	Avogadro. 6.
" "	"	.19762. Corundum }	20.31	{ Regnault. 11.
" "	"	.21732. Sapphire. }	22.34	
Cerium "	Ce ₂ O ₃ .	.0984.	22.83	Hermann.Gm.H.I
Yttrium "	Y O.	.1347.	10.20	" " "
Glucinum "	Gl O.	.2637.		" " "
Boron trioxide.	B ₂ O ₃ .	.23743.	16.62	Regnault. 11.
" "	"	.2341. Fused.	16.39	Neumann. 33.
Vanadium "	V ₂ O ₃ .	.1936. }	29.23	{ Schafarik. Wien
" "	"	.1918. }	28.96	
" "	"	.2049. }	30.94	
" "	"	.2002. }	30.23	
Arsenic "	As ₂ O ₃ .	.1319.	26.12	Hermann.Gm.H.I
" "	"	.141.	27.91	Avogadro. 6.
" "	"	.12786.	25.32	Regnault. 11.
" "	"	.1309. White. }	25.92	{ Delarive & Marcet. 10.
" "	"	.1320. Vitreous. }	26.13	

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Arsenic trioxide.	As ₂ O ₃ .	.1638.	} Too high.	{ Schafarik. Wien Ak. 47. 246.
" "	"	.1570.		
Antimony "	Sb ₂ O ₃ .	.130.		Neumann. 4.
" "	"	.09009.	26.31	Regnault. 11.
" "	"	.0926.	27.04	Neumann. 88.
" tetroxide.	Sb ₂ O ₄ .	.09535.	29.37	Regnault. 11.
Bismuth trioxide	Bi ₂ O ₃ .	.06053.	28.33	Regnault. 11.
Silicon dioxide.	Si O ₂ .	.195. Agate.	11.70	Crawford. See 6.
" "	"	.1883. Quartz	11.30	{ Neumann. 4.
" "	"	.1894. } cryst.	11.36	
" "	"	.1719. Quartz.	10.31	Hermann.Gm.H.I
" "	"	.179. "	10.74	Avogadro. 6.
" "	"	.19132.	11.48	Regnault. 11.
" "	"	.186. Quartz.	11.16	Kopp. 34.
Titanium "	Ti O ₂ .	.1724. Rutile.	14.14	Neumann. 4.
" "	"	.1630. "	13.36	Hermann.Gm.H.I
" "	"	.17032. "	13.08	{ Regnault. 11.
" "	"	.17164. Artificial.	14.07	
" "	"	.157. Rutile.	12.87	{ Kopp. 34.
" "	"	.161. Brookite.	13.20	
" "	"	.1785. }	14.64	{ Schüller & v. Wartha. 46.
" "	"	.1779. } Artificial	14.59	
" "	"	.1737. Rutile.	14.24	
Tin monoxide.	Sn O.	.096.	12.86	Crawford. See 6.
" "	"	.094.	12.59	Avogadro. 6.
" dioxide.	Sn O ₂ .	.096.	14.40	Crawford. See 6.
" "	"	.0990.	14.85	Crawford. See Gilb. Ann. 5. 43.
" "	"	.0895. }	13.42	{ Neumann. 4.
" "	"	.0965. } Tinstone.	14.47	
" "	"	.0931. } By two methods.	13.96	
" "	"	.0900. Tinstone.	13.50	Hermann.Gm.H.I
" "	"	.111.	16.65	Avogadro. 6.
" "	"	.09326.	13.99	Regnault. 13.
" "	"	.0894. Tinstone.	13.40	Kopp. 34.
Chromite.	Fe O Cr ₂ O ₃ .	.159.	35.77	Kopp. 34.
Spinel.	Mg O Al ₂ O ₃ .	.194.	27.70	Kopp. 34.
Iserine.	—	.1762.		Neumann. 4.
"	—	.177.		Kopp. 34.

IV. INORGANIC SULPHIDES, ARSENIDES, AND NITRIDES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Silver sulphide.	Ag ₂ S.	.07460.	18.50	Regnault. 11.
Selenium "	Se S.	.1274.	14.21	Ditte. A. C. P. 163. 187.
Lead "	Pb S.	.044. By mixture.	10.52	{ Neumann. 4.
" "	"	.053. By cooling.	12.66	
" "	"	.0527.	13.79	Hermann.Gm.H.I
" "	"	.046.	10.99	Avogadro. 6.
" "	"	.05086.	12.16	Regnault. 11.
" "	"	.0490. Galena.	11.71	Kopp. 34.
Iron monosulphide.	Fe S.	.1396, 5°-15°.	12.28	Delarive & Marcet. 10.
" "	"	.13570.	11.94	Regnault. 11.
Iron disulphide.	Fe S ₂ .	.1275.	15.30	{ Neumann. 4.
" "	"	.1310. } Pyrite.	15.72	
" "	"	.1323. }	15.87	
" "	"	.1332. } Marca-site.	15.99	
" "	"	.1282. }	15.38	
" "	"	.135.	16.20	Avogadro. 6.
" "	"	.13009.	15.71	Regnault. 11.
" "	"	.126. Pyrite.	15.12	Kopp. 34.
Pyrrhotite.	Fe ₇ S ₈ .	.1533.	99.34	Neumann. 4.
"	"	.16023.	103.83	Regnault. 11.
Nickel sulphide.	Ni S.	.12813.	11.62	" "
Cobalt "	Co S.	.12512.	11.35	" "
Cuprous "	Cu ₂ S.	.12118.	19.27	" "
" "	"	.120. Cuprite.	19.08	Kopp. 34.
Molybdenite.	Mo S ₂ .	.1067. By mixture.	17.06	{ Neumann. 4.
"	"	.102. By cooling.	16.31	
"	"	.1097, 5°-15°.	17.54	Delarive & Marcet. 10.
"	"	.12334.	19.72	Regnault. 11.
Zinc sulphide.	Zn S.	.1145. } Blende.	11.13	{ Neumann. 4.
" "	"	.113. } By mixture.	10.98	
" "	"	.112. By cooling.	10.89	
" "	"	.12303.	11.96	Regnault. 11.
" "	"	.120. Blende.	11.66	Kopp. 34.
Mercuric "	Hg S.	.0520. Cinnabar.	12.06	Neumann. 4.
" "	"	.0528.	12.25	Hermann.Gm.H.I
" "	"	.048.	11.14	Avogadro. 6.
" "	"	.0597, 5°-15°.	13.85	Delarive & Marcet. 10.
" "	"	.05117.	11.87	Regnault. 11.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Mercuric sulphide.	Hg S.	.0517. Cinnabar.	11.99	Kopp. 34.
Arsenic disulphide.	As ₂ S ₂ .	.1111. By mixture.	23.78	{ Neumann. 4.
" "	"	.130. By cooling.	27.82	
" trisulphide.	As ₂ S ₃ .	.1132. Orpiment.	27.85	Neumann. 4.
" "	"	.1132.	27.85	Hermann.Gm.H.I
" "	"	.105.	25.73	Avogadro. 6.
Antimony "	Sb ₂ S ₃ .	.0907. Stibnite.	30.83	{ Neumann. 4.
" "	"	.0877.	29.82	
" "	"	.083. } By mixture	28.22	
" "	"	.092. By cooling.	31.28	
" "	"	.0995.	33.83	Hermann.Gm.H.I
" "	"	.1286, 5°-15°	43.72	Delarive & Marcet. 10.
" "	"	.08403.	28.57	Regnault. 11.
Bismuth "	Bi ₂ S ₃ .	.06002.	30.97	Regnault. 11.
Carbon disulphide.	C S ₂ .	.1969.		Hermann.Gm.H.I
" "	"	.329.		Delarive & Marcet. 10.
" "	"	.2179, 5°-10°	16.56	{ Regnault. 13.
" "	"	.2183, 10°-15°.	16.59	
" "	"	.2206, 15°-20°.	16.76	
" "	"	.23878, 30°.	18.15	
" "	"	.242594, 40°.	18.44	
" "	"	.246143, 50°.	18.71	
" "	"	.248967, 60°.	18.92	
" "	"	.252141, 70°.	19.16	
" "	"	.255309, 80°.	19.40	
" "	"	.258496, 90°.	19.65	
" "	"	.262172, 100°.	19.92	
" "	"	.264901, 110°.	20.13	
" "	"	.268137, 120°.	20.38	
" "	"	.271404, 130°.	20.63	
" "	"	.276782, 140°.	21.04	
" "	"	.282198, 150°.	21.45	
" "	"	.288195, 160°.	21.90	
" "	"	.2575, 4° 47'-5° 88'	19.57	{ Winkelmann. 44.
" "	"	.2603, 5° 89'-6° 27'	19.78	
" "	"	.2567, 4° 57'-6° 01'	19.51	
" "	"	.2596, 5° 27'-6° 59'	19.73	
" "	"	.2595, 16° 08'-17° 50'	19.72	
" "	"	.2618, 17° 40'-18° 62'	19.89	
" "	"	.2607, 17° 42'-18° 55'	19.81	

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Tin monosulphide.	Sn S_2	.08365.	12.55	Regnault. 11.
" disulphide.	Sn S_2	.11932.	20.73	Regnault. 11.
Chalcopyrite.	$\text{Cu S. Fe S. Fe S}_2$	.1289.	39.12	Neumann. 4.
"	"	.131.	39.76	Kopp. 34.
Mispickel.	Fe S_2 Fe As_2	.1012.	32.99	Neumann. 4.
Cobaltite.	Co S_2 Co As_2	.1070.	35.46	Neumann. 4.
Smaltite.	$(\text{Co Ni Fe}) \text{As}_2$	.0920.		Neumann. 4.
Titanium nitride	Ti N_2	.2267, 100°-0°.	17.68	Schüller & v. Wartha. 46.

V. INORGANIC HYDRATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Iodic acid.	H IO_3	.1625.	28.60	Ditte. A. C. Phys. (4). 21. 63.
Potassium hydrate.	K H O	.358.	20.05	Avogadro. 6.
Sulphuric acid.	$\text{H}_2 \text{ SO}_4$.3500.	34.30	Dalton. Gm. H. I.
" "	"	.349.	34.20	Delarive & Marcet. 10.
" "	"	.343, 21°-46°.	33.61	Kopp. 16.
" "	"	.3315, 17°-22°.	32.49	Marignac. A. C. Phys. (4). 22. 385.
" "	"	.3363, 20°-56°.	32.96	
" "	"	.3413, 13°-77°.	33.45	Pfaundler. A.S.P. N. (2). 30. 352.
" "	"	.3542, 16°-98°.	34.71	
" "	"	.3740, 15°-137°.	36.65	Pfaundler. C.S.J. (2). 9. 195.
" "	"	.355, 22°-80°.	34.79	
" "	"	.356, 22°-90°.	34.89	
" "	"	.358, 22°-100°.	35.08	
" "	"	.359, 22°-110°.	35.18	
" "	"	.360, 22°-120°.	35.28	
" "	"	.362, 22°-130°.	35.47	
" "	"	.364, 22°-140°.	35.67	
" "	"	.365, 22°-150°.	35.77	
" "	"	.367, 22°-160°.	35.97	
" "	"	.370, 22°-170°.	36.26	
" "	$\text{H}_2 \text{ SO}_4 \cdot \text{H}_2 \text{ O}$.4411, 20°-56°.	51.17	Marignac. A. C. Phys. (4.) 22. 385.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sulphuric acid.	$H_2SO_4, H_2O.$.4478, 14°-75.°	51.94	Pfaundler. A. S. P. N. (2). 30.352.
" "	"	.4527, 15°-28.°	52.51	
" "	"	.444, 22°-70.°	51.50	Pfaundler. C. S. J. (2). 9. 195.
" "	"	.447, 22°-80.°	51.85	
" "	"	.450, 22°-90.°	52.20	
" "	"	.454, 22°-100.°	52.66	
" "	"	.458, 22°-110.°	53.12	
" "	"	.461, 22°-120.°	53.47	
" "	"	.465, 22°-130.°	53.94	
" "	"	.469, 22°-140.°	54.40	
" "	"	.472, 22°-150.°	54.75	
" "	"	.475, 22°-160.°	55.10	
" "	"	.479, 22°-170.°	55.56	Pfaundler. A. S. P. N. (2). 30.352.
" "	"	.482, 22°-180.°	55.91	
" "	$H_2SO_4, 2H_2O.$	.4703, 14°-70.°	63.02
" "	"	.4703, 16°-98.°	63.02	
" "	"	.442, 22°-60.°	59.22	
" "	"	.446, 22°-70.°	59.76	
" "	"	.450, 22°-80.°	60.30	
" "	"	.455, 22°-90.°	60.97	
" "	"	.459, 22°-100.°	61.50	
" "	"	.462, 22°-110.°	61.90	
" "	"	.466, 22°-120.°	62.44	Pfaundler. C. S. J. (2). 9. 195.
" "	"	.470, 22°-130.°	62.98	
" "	"	.474, 22°-140.°	63.52	
" "	"	.478, 22°-150.°	64.06	
" "	"	.482, 22°-160.°	64.60	
" "	$H_2SO_4, 5H_2O.$	.5764, 15°-19.°	108.36
" "	"	.5833, 20°-56.°	109.66	
Calcium hydrate	$CaH_2O_2.$.4000.		Dalton. Gm. H. I.
" "	"	.300.	22.20	Avogadro. 6.
Magnesium "	$MgH_2O_2.$.312. Brucite.	18.10	Kopp. 34.
Manganic "	$Mn_2O_3, H_2O.$.176. Manganite.	30.98	Kopp. 34.
Ferric "	$(Fe_2O_3)_7, 3H_2O.$.188.	70.31	Avogadro. 6.
Aluminum "	$Al_2O_3, 3H_2O.$.420.	65.86	Avogadro. 6.
Nitric acid.	$HNO_3.$.4450.	28.03	Hess. Gm. H. I.

VI. CHLORATES AND PERCHLORATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Potassium chlorate.	$K Cl O_3$.	.20956.	25.69	Regnault. 11.
" "	"	.194.	23.78	Kopp. 34.
Barium "	$Ba Cl_2 O_6 H_2 O$.	.157.	50.55	Kopp. 34.
Potassium perchlorate.	$K Cl O_4$.	.190.	26.33	Kopp. 34.

VII. HYPOSULPHITES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium hyposulphite.	$Na_2 S_2 O_3 \cdot 5 H_2 O$.	.221.	54.81	Pape. 32.
Potassium "	$K_2 S_2 O_3$.	.197.	37.47	" "
Barium "	$Ba S_2 O_3 \cdot H_2 O$.	.163.	43.52	" "
Lead "	$Pb S_2 O_3$.	.092.	29.35	" "

VIII. SULPHATES.

1st. ANHYDROUS SULPHATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium sulphate	$Na_2 S O_4$.	.263.	37.34	Avogadro. 6.
" "	"	.23115.	32.82	Regnault. 11.
" "	"	.2280.	32.38	Neumann. 33.
" "	"	.227.	32.23	Kopp. 34.
" "	"	.2293.	32.56	Schüller. 37.
Potassium "	$K_2 S O_4$.	.169.	29.44	Avogadro. 6.
" "	"	.19010.	33.11	Regnault. 11.
" "	"	.1860.	32.40	Neumann. 33.
" "	"	.196.	34.14	Kopp. 34.
" bisulphate.	$K H S O_4$.	.244.	33.21	Kopp. 34.
Ammonium sulphate.	$(N H_4)_2 S O_4$.	.350.	46.20	Kopp. 34.
Calcium "	$Ca S O_4$.	.1854. By mixture.	25.21	{ Neumann. 4.
" "	"	.169. By cooling.	22.98	
" "	"	.190.	25.84	Avogadro. 6.
" "	"	.19656.	26.73	Regnault. 11.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Calcium sulphate.	Ca S O_4 .	.178. Anhydrite.	24.21	Kopp. 34.
Strontium "	Sr S O_4 .	.1356. } Celestine.	24.88	{ Neumann. 4.
" "	"	.130. }	23.86	
" "	"	.14279.	26.20	Regnault. 11.
" "	"	.135. Celestine.	24.77	Kopp. 34.
Barium "	Ba S O_4 .	.1088. Barite. }	25.35	{ Neumann. 4.
" "	"	.1071. "	24.95	
" "	"	.1072. "	24.98	
" "	"	.1060. "	24.70	
" "	"	.11285.	26.29	Regnault. 11.
" "	"	.108. Barite.	25.16	Kopp. 34.
Lead "	Pb S O_4 .	.0848. Anglesite.	25.69	Neumann. 4.
" "	"	.08723.	26.43	Regnault. 11.
" "	"	.0827.	25.06	Kopp. 34.
Manganous "	Mn S O_4 .	.182.	27.48	Pape. 29.
Ferrous "	Fe S O_4 .	.145.	22.04	Avogadro. 6.
Nickelous "	Ni S O_4 .	.216.	33.42	Pape. 29.
Copper "	Cu S O_4 .	.180.	28.71	Avogadro. 6.
" "	"	.184.	29.35	Pape. 29.
Zinc "	Zn S O_4 .	.213.	34.34	Avogadro. 6.
" "	"	.174.	28.05	Pape. 29.
Magnesium "	Mg S O_4 .	.1011. (Toolow.Ed.)		Rudberg. P. A. 35.
" "	"	.22159.	26.59	Regnault. 11.
" "	"	.225.	27.00	Pape. 29.
" "	"	.2165.	25.98	Neumann. 33.

2d. HYDRATED SULPHATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Calcium sulphate.	$\text{Ca S O}_4 \cdot 2\text{H}_2\text{O}$.	.302. Gypsum.	51.94	Avogadro. 6.
" "	"	.2728. - "	46.92	Neumann. 33.
" "	"	.259. "	44.54	Kopp. 34.
Manganous "	$\text{Mn S O}_4 \cdot 5\text{H}_2\text{O}$.	.338.	81.46	Pape. 29.
" "	"	.323.	77.84	Kopp. 34.
Ferrous "	$\text{Fe S O}_4 \cdot 7\text{H}_2\text{O}$.	.357.	99.25	Pape. 29.
" "	"	.346.	96.19	Kopp. 34.
Nickelous "	$\text{Ni S O}_4 \cdot \text{H}_2\text{O}$.	.237.	40.93	Pape. 29.
" "	$\text{Ni S O}_4 \cdot 6\text{H}_2\text{O}$.	.313.	82.23	Kopp. 34.
" "	$\text{Ni S O}_4 \cdot 7\text{H}_2\text{O}$.	.341.	95.72	Pape. 29.
Cobaltous "	$\text{Co S O}_4 \cdot 7\text{H}_2\text{O}$.	.343.	96.28	Kopp. 34.
Copper "	$\text{Cu S O}_4 \cdot \text{H}_2\text{O}$.	.202.	35.85	Pape. 29.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Copper sulphate.	$\text{Cu S O}_4 \cdot 2\text{H}_2\text{O}$.	.212.	41.46	Pape. 29.
" "	$\text{Cu S O}_4 \cdot 3\text{H}_2\text{O}$.	.247.	52.73	" "
" "	$\text{Cu S O}_4 \cdot 5\text{H}_2\text{O}$.	.316.	78.84	" "
" "	"	.285.	71.11	Kopp. 34.
Zinc "	$\text{Zn S O}_4 \cdot \text{H}_2\text{O}$.	.202.	36.20	Pape. 29.
" "	$\text{Zn S O}_4 \cdot 2\text{H}_2\text{O}$.	.224.	44.17	" "
" "	$\text{Zn S O}_4 \cdot 7\text{H}_2\text{O}$.	.328.	94.20	" "
" "	"	.347.	99.66	Kopp. 34.
Magnesium "	$\text{Mg S O}_4 \cdot \text{H}_2\text{O}$.	.265.	36.57	Pape. 29.
"	$\text{Mg S O}_4 \cdot 7\text{H}_2\text{O}$.	.2906.		Rudberg. P. A. 35. 474.
" "	"	.407.	100.12	Pape. 29.
" "	"	.362	89.05	Kopp. 34.
Magnesium potassium sulphate.	$\text{MgK}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$.	.264.	106.18	Kopp. 34.
Nickel " "	$\text{Ni K}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$.	.245.	107.04	" "
Zinc " "	$\text{Zn K}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$.	.270.	119.72	" "
Potash alum.	$\text{Al K}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.	.371.	176.04	" "
Chrome "	$\text{Cr K}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.	.324.	161.87	" "

IX. CHROMATES, PERMANGANATES, MOLYBDATES, AND TUNGSTATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Potassium chromate.	$\text{K}_2\text{Cr O}_4$.	.18505.	36.03	Regnault. 11.
" "	"	.1840.	35.82	Neumann. 33.
" "	"	.189.	36.80	Kopp. 34.
Potassium dichromate.	$\text{K}_2\text{Cr}_2\text{O}_7$.	.18937.	55.90	Regnault. 11.
" "	"	.1857.	36.25	Neumann. 33.
" "	"	.186.	44.91	Kopp. 34.
Lead chromate.	Pb Cr O_4 .	.0900.	29.11	" "
Potassium permanganate.	K Mn O_4 .	.179.	28.30	" "
Lead molybdate.	Pb Mo O_4 .	.0827. Natural.	30.34	" "
Calcium tungstate.	Ca W O_4 .	.0967	27.85	" "
Wolfram.	$(\text{Fe Mn})\text{W O}_4$.	.09780.		Regnault. 11.
"	"	.0930.		Kopp. 34.

X. BORATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium borate.	Na B O_3	.25709.	16.97	Regnault. 11.
" "	"	.2364.	15.60	Neumann. 33.
" diborate.	$\text{Na}_2 \text{B}_4 \text{O}_7$	.23823.	48.12	Regnault. 11.
" "	"	.229.	46.26	Kopp. 34.
" "	$\text{Na}_2 \text{B}_4 \text{O}_7 \cdot 10 \text{H}_2 \text{O}$	.385.	147.07	" "
Potassium borate	K B O_3	.20478.	16.81	Regnault. 11.
" diborate	$\text{K}_2 \text{B}_4 \text{O}_7$	.21975.	51.47	" "
Lead borate.	$\text{Pb B}_2 \text{O}_4$	.09046.	26.50	" "
" diborate.	$\text{Pb B}_4 \text{O}_7$	.11409.	41.41	" "

XI. NITRATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium nitrate.	Na N O_3	.240.	20.40	Avogadro. 6.
" "	"	.27821.	23.65	Regnault. 11.
" "	"	.2747.	23.35	Neumann. 33.
" "	"	.256. Fused.	21.76	{ Kopp. 34.
" "	"	.257. Crystals.	21.84	
" "	"	.2650.	21.52	Schüller. 37.
" "	"	.413, 330°-430° L.	35.10	Person. 15.
" "	"	.3975, 320°-430° "	33.79	Person. P.A. 74.509
Potassium nitrate.	K N O_3	.269.	27.19	Avogadro. 6.
" "	"	.23875.	24.14	Regnault. 11.
" "	"	.2343.	23.69	Neumann. 33.
" "	"	.256. Fused.	25.88	{ Kopp. 34.
" "	"	.257. Crystals.	25.98	
" "	"	.344, 350°-435° L.	34.78	Person. 15.
" "	"	.33186, 350°-435° "	33.55	Person. P.A. 74.509
Sodium potassium nitrate.	$\text{K N O}_3 \cdot \text{Na N O}_3$	.235.	43.73	Kopp. 34.
Ammonium nitrate.	$\text{N H}_4 \text{N O}_3$	.455.	36.40	Kopp. 34.
Silver nitrate.	Ag N O_3	.14352.	24.40	Regnault. 11.
" "	"	.1395.	23.71	Neumann. 33.
Strontium "	$\text{Sr N}_2 \text{O}_6$	.1683.	35.59	Hermann. Gm.H.I
" "	"	.181.	38.28	Kopp. 34.
Barium "	$\text{Ba N}_2 \text{O}_6$	.1334.	34.82	Hermann. Gm.H.I
" "	"	.15228.	39.75	Regnault. 11.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Barium nitrate.	Ba N ₂ O ₆	.1492.	38.94	Neumann. 33.
" "	"	.145.	37.84	Kopp. 34.
Lead "	Pb N ₂ O ₆	.1173.	38.83	Neumann. 33.
" "	"	.110.	36.41	Kopp. 34.

XII. PHOSPHATES, ARSENATES, AND NIOBATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Sodium meta-phosphate.	Na P O ₄ .	.217.	22.13	Kopp. 34.
Sodium pyro-phosphate.	Na ₂ P ₂ O ₇ .	.22833.	60.74	Regnault. 11.
Sodium phosphate.	Na ₂ H PO ₄ 12 H ₂ O.	.454, -20. to +2°	167.07	{ Person. 15.
" "	"	.758, 44°—79°.	278.94	
Potassium pyro-phosphate.	K ₂ P ₂ O ₇ .	.19102.	63.11	Regnault. 11.
Potassium phosphate.	K H ₂ P O ₄ .	.280.	38.11	Kopp. 34.
Silver phosphate.	Ag ₃ P O ₄ .	.0896.	37.54	Kopp. 34.
Calcium meta-phosphate.	Ca P ₂ O ₆ .	.19923.	39.45	Regnault. 11.
Apatite.	3 Ca ₃ P ₂ O ₈ Ca Cl ₂ .	.1787.	186.03	Hermann.Gm.H.I
Lead pyrophosphate.	Pb ₂ P ₂ O ₇ .	.08208.	45.72	Regnault. 11.
Lead phosphate.	Pb ₃ P ₂ O ₈ .	.07982.	64.73	Regnault. 11.
Potassium meta-arsenate.	K As O ₃ .	.15631.	25.34	Regnault. 11.
" arsenate.	K H ₂ As O ₄ .	.175.	31.52	Kopp. 34.
Lead "	Pb ₃ As ₂ O ₈ .	.07280.	65.45	Regnault. 11.
Samarskite.		.10066, before ign. }		{ H. Rose. P. A.
"		.096, after ignition. }		

XIII. CARBONATES.

Name.	Formula.	Specific Heat.	Molec. Heat.	Authority.
Sodium carbonate.	Na_2CO_3 .	.306.	32.44	Avogadro. 6.
" "	"	.27275.	28.91	Regnault. 11.
" "	"	.246.	26.08	Kopp. 34.
Potassium "	K_2CO_3 .	.237.	32.75	Avogadro. 6.
" "	"	.21623.	29.88	Regnault. 11.
" "	"	.2046.	28.28	Neumann. 33.
" "	"	.206.	28.47	Kopp. 34.
Rubidium "	Rb_2CO_3 .	.123.	28.39	Kopp. 34.
Calcium "	CaCO_3 .	.256.	25.60	Crawford. See 6.
" "	"	.207.	20.70	Gadolin. See 6.
" "	"	.2700.	27.00	Dalton. Gm. H. I.
" "	"	.2015.	20.15	Neumann. 4.
" "	"	.2091.	20.91	
" "	"	.2096.	20.96	
" "	"	.2046.	20.46	
" "	"	.195. Calcite. By cooling.	19.50	
" "	"	.1966. } Arragonite.	19.66	
" "	"	.2018. } By mixture.	20.18	
" "	"	.203. Marble.	20.30	
" "	"	.1945. Calcite.	19.45	
" "	"	.20858. Calcite.	20.86	
" "	"	.20850. Arragonite.	20.85	Regnault. 11.
" "	"	.21585. } Marble. Two	21.58	
" "	"	.20989. } kinds.	20.99	
" "	"	.21485. Chalk.	21.48	
" "	"	.2038. } Extremes of 19	20.38	Regnault. 30.
" "	"	.2087. } determinations.	20.87	
" "	"	.206. Calcite.	20.60	Kopp. 34.
" "	"	.203. Arragonite.	20.30	
Strontium "	SrCO_3 .	.1445.	21.31	Neumann. 4.
" "	"	.14483.	21.36	Regnault. 11.
Barium "	BaCO_3 .	.1078. Witherite.	21.24	Neumann. 4.
" "	"	.11038.	21.74	Regnault. 11.
Lead "	PbCO_3 .	.0814. Cerussite.	21.73	Neumann. 4.
" "	"	.0818. "	21.84	Hermann. Gm. H. I.
" "	"	.08596. Impure.	22.95	Regnault. 11.
" "	"	.0791. Cerussite.	21.12	Kopp. 34.
Ferrous "	FeCO_3 .	.1820. By mixture.	21.11	Neumann. 4.
" "	"	.183. By cooling.	21.23	
" "	"	.19345.	22.44	Regnault. 11.
" "	"	.166. Very impure.		Kopp. 34.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Zinc carbonate.	Zn C O_3 .	.1712. By mixture.	21.43	{ Neumann. 4.
"	"	.161. By cooling.	20.16	
Dolomite.	$(\text{Mg Ca}) \text{ C O}_3$.	.2179.	{	Neumann. 4.
"	"	.2137.		
"	"	.2270. Bitterspar.		
"	"	.2168. Gurhofian.		
"	"	.21743. Very impure	Regnault. 11.	Kopp. 34.
"	"	.206. Bitter spar.		
Ankerite.	$(\text{Mg Ca Fe}) \text{ C O}_3$.	.1963.		Neumann. 4.

XIV. SILICATES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Glass.		.1900. Flint glass.		Dalton. Gm. H I.
"		.1770, 0°-100°.		{ Dulong & Petit. 1
"		.1900, 0°-300°.		
"		.19768.		Regnault. 7.
" Glass tears.		.1923. Hard.		{ Regnault. 13.
" " "		.1937. Annealed.		
Zircon.	Zr O ₂ . Si O ₂ .	.14588.	26.50	Regnault. 11.
"	"	.132	23.97	Kopp. 34.
Chrysolite.	(MgO.FeO) ₂ . Si O ₂ .	.2056.		Neumann. 4.
"	"	.189.		Kopp. 34.
Pyrope.		.1949.		Neumann. 33.
Topaz.		.2017.		Neumann. 4.
Diopase.	Cu Si O ₃ . H ₂ O.	.182.	28.66	Kopp. 34.
Wollastonite.	Ca Si O ₃ .	.178.	20.65	Kopp. 34.
Albite.		.1961.		Neumann. 4.
"		.190.		Kopp. 34.
Orthoclase (Felspar).		.1911.		{ Neumann. 4.
" "		.1861. Adularia.		
" "		.183.		Kopp. 34.
Labradorite.		.1926.		Neumann. 4.
Hornblende.		.1976. From two		{ Neumann. 4.
"		.1958. localities.		
Tremolite.		.2070.		Neumann. 4.
Actinolite.		.2046.		" "
Augite.		.1938.		" "
Diopside.	Ca Si O ₃ . Mg Si O ₃ .	.1906.	41.17	" "
"	"	.186.	40.17	Kopp. 34.
Zoisite.		.1940.		Neumann. 4.
Gadolinite.		.138. Before ignition		{ H. Rose. P.A. 103.
"		.128. After "		

XV. ALLOYS.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Lead and mercury.	Hg Pb.	.03234.	13.16	Regnault. 11.
Lead and antimony.	Sb Pb.	.03883.	12.78	" "
Lead and bismuth.	Bi, Pb.	.0350. L. melted.	51.03	Person. P. A. 76. 426.
Lead and tin.	Sn Pb.	.04039.	13.13	Regnault. 11.
" " "	Sn, Pb.	.04461.	19.76	" "
Mercury " "	Sn Hg.	.04172.	13.27	" "
" " "	Sn, Hg.	.04563.	19.89	" "
Bismuth " "	Sn Bi.	.03987.	13.08	" "
" " "	Sn, Bi.	.04415.	19.69	" "
" " "	Sn, Bi.	.0452. } L. melted.	71.14	{ Person. P. A. 76.
" " "	"	.0456. }	71.77	{ 426.
Brass.		.09391.		Regnault. 7.
Cymbal metal.		.0858. Brittle. }		{ Regnault. 13.
" "		.0862. Soft. }		
German silver.		.0944.		Weber. P. A. 146. 257.
Lead, tin, bismuth.	Pb Sn, Bi.	.04012.	26.20	Regnault. 11.
" " "	Pb Sn, Bi.	.03785.	32.66	Regnault. 11.
" " "	Pb, Sn, Bi.	.046, 143°-330°.	60.10	Person. 15.
" " "	"	.0412. } L. melted.	53.81	{ Person. P. A.
" " "	"	.0432. }	56.42	{ 76. 426.
" " "	Pb, Sn, Bi.	.049, 12°-50°.	94.57	{
" " "	"	.060, 14°-80°.	115.80	{ Person. 15.
" " "	"	.047, 107°-136°.	90.71	{
" " "	"	.036, 136°-300°.	69.48	{
" " "	"	.0385. } L. melted.	74.30	{ Person. P. A. 76.
" " "	"	.0392. }	75.66	{ 426.
Antimony, bismuth, tin.	Sb Bi Sn.	.04564.	25.92	Regnault. 11.
Antimony, bismuth, tin, zinc.	Sb Bi Sn, Zn.	.05479.	38.32	" "
Copper, tin, zinc. }	83.5 per cent.	.0879. At first. }		{ Mallet. P. M. (8).
" " " }	Cu; 8.833 Sn;	.0848. After long friction. }		{ 23. 144.
" " " }	7.51 Zn.			

XVI. CYANIDES.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Mercuric cyanide.	Hg Cy.	.100.	25.00	Kopp. 34.
Potassium zinc cyanide.	(K Cy) ₂ Zn Cy.	.241.	59.62	" "
" ferrocyanide.	K ₄ Cy ₆ Fe. 3H ₂ O.	.280.	118.27	" "
" ferricyanide.	K ₃ Cy ₆ Fe.	.233.	76.73	" "

XVII. HYDROCARBONS.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Benzol.	C ₆ H ₆ .	.475.	37.05	Delarive & Marcet.
"	"	.3999, 5°-10.°	31.19	[10. Regnault. 18.
"	"	.3865, 10°-15.°	30.15	
"	"	.3932, 15°-20.°	30.67	
"	"	.450, 19°-46.°	35.10	Kopp. 16.
"	"	.5250, 3°32'-4°61'	40.95	Winkelmann. 44.
"	"	.5257, 4°08'-5°22'	41.00	
"	"	.5272, 17.°65'-18.°89.	41.12	
"	"	.5296, 17.°95'-19.°06.	41.31	
Naphthaline.	C ₁₀ H ₈ .	.32075, 0.°	41.06	Alluard. A. C. Phys. (3). 57. 438.
"	"	.3249, 20°60° } S.	41.59	
"	"	.4176, 80°130° L.	53.45	
Oil of citron.	C ₁₀ H ₁₆ .	.4879.	66.35	Regnault. 18.
" " "	"	.4489, 5°-10.°	61.05	
" " "	"	.4424, 10°-15°	60.17	
" " "	"	.4501, 15°-20°	61.21	
" " "	"	.50233.	68.32	Favre and Silbermann. C.R. 23. 411.
" " orange.	"	.4886.	66.45	Regnault 18.
" " juniper.	"	.4770.	64.87	" "
Camphilene.	"	.4518.	61.44	" "
Terebilene.	"	.4580.	62.28	" "
Terebene.	"	.4656.	63.32	" "
"	"	.4154, 5°-10.°	56.49	
"	"	.4156, 10°-15°	56.52	
"	"	.4267, 15°-20°	58.03	
"	"	.52409.	71.28	Favre and Silbermann. C.R. 23. 411.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Oil of turpentine.	$C_{10}H_{16}$	.4880.	66.37	Kirwan. Gm. H. I.
" " "	"	.4620.	62.83	Despretz. "
" " "	"	.42593.	57.93	Regnault. 8. [10.
" " "	"	.488.	66.37	Delarive & Marcet.
" " "	"	.4672.	63.54	Regnault. 13.
" " "	"	.46727.	63.55	Favre and Silbermann. J. 6. 78.
" " "	"	.4517. }	61.43	{ Schnidaritsch.
" " "	"	.4318. }	58.72	{ Wien. Ak. 38.39.
" " "	"	.440.	59.84	Pape. 29.
" " "	"	.4393, m. of 4. }	59.74	{ Neumann. 38.
" " "	"	.4087, m. of 12. }	55.58	{
" " "	"	.46842116, 40°. }	63.71	{
" " "	"	.52421905, 80°. }	71.29	{ Hirn. J. 20. 56.
" " "	"	.57117195, 120° }	77.68	{
" " "	"	.61257810, 160° }	83.31	{
" " "	"	.4321.	58.76	Pfaundler. A. C.
Petrolene.		.4684.		Phys. (4). 22.58.
"		.4321, 5°-10°. }		{ Regnault. 13.
"		.4325, 10°-15°. }		{
"		.4342, 15°-20°. }		{ [10.
Naphtha.		.493.		Delarive & Marcet.
"		.431. }		{ Kopp. 34.
"		.419. }		{
Paraffin.		.683, m. of 3.		Bolley. J. F. P. 103. 481.

XVIII. COMPOUNDS CONTAINING C, H, AND O.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Methyl alcohol.	$C H_4 O$	.5901, 5°-10°. }	18.88	{
" "	"	.5868, 10°-15°. }	18.77	{ Regnault. 13.
" "	"	.6009, 15°-20°. }	19.23	{
" "	"	.613, m of 2.	19.61	Andrews. C. S. J. 1. 27.
" "	"	.625, 23°-43°. }	20.00	Kopp. 16.
" "	"	.67127.	21.48	Favre and Silbermann. C. R. 23. 411.
" "	"	.58325.	18.66	Dupré. P. A. 148. 236.
Ethyl "	$C_2 H_4 O$	.6620.	30.45	Despretz. Gm. H. I.

Name.	Formula.	Specific Heat.	Molec. Heat.	Authority.
Ethyl alcohol.	$C_2 H_6 O$.	.632.	29.07	Delarive and Marcet. 10.
"	"	.5987, 5°-10°.	27.54	{ Regnault. 13.
"	"	.6017, 10°-15°.	27.68	
"	"	.6148, 15°-20°.	28.28	
"	"	.617.	28.38	Andrews. C. S. J. 1. 27.
"	"	.615, 23°-43°.	28.29	Kopp. 16.
"	"	.6438.	29.01	Favre and Silbermann. J. 6. 78.
"	"	.64490.	29.66	Favre and Silbermann. C. R. 23. 411.
"	"	.6219.	28.61	Schnidaritsch. Fortsch. d. Phys. 15. 362.
"	"	.5748.	26.44	Neumann. 33.
"	"	.59167637, 40°	27.22	{ Hirn. J. 20. 56.
"	"	.71125991, 80°	32.71	
"	"	.85941613, 120°	39.53	
"	"	.1.11389145, 160°	51.23	
"	"	.580, 0°.	27.68	Jamin & Amaury. C. R. 70. 1237.
"	"	.60430.	27.79	Dupré & Page. 38.
"	"	.58081, 3° 82-4° 99.	26.72	{ Winkelmann. 44
"	"	.57961, 4° 49-5° 67.	26.66	
"	"	.60004, 16° 33-17° 36.	27.60	
"	"	.60254, 16° 61-17° 73.	27.72	
"	"	.62281, 27° 29-28° 32.	28.65	
"	"	.62219, 27° 23-28° 03.	28.62	
"	"	.62307, 27° 35-28° 18.	28.66	
Amyl	$C_5 H_{12} O$.	.564, 26°-44°.	50.63	Kopp. 16.
"	"	.58728.	51.68	Favre and Silbermann. C. R. 23. 411.
Cetyl	$C_{16} H_{34} O$.	.51600.	124.87	Favre and Silbermann. C. R. 23. 411.
Ethyl oxide.	$C_4 H_{10} O$.	.5200.	38.48	Despretz. Gm. H. I.
"	"	.550.	40.70	Delarive and Marcet. 10.
"	"	.5207, 5°-10°.	38.53	{ Regnault. 13.
"	"	.5158, 10°-15°.	38.17	
"	"	.5157, 15°-20°.	38.16	
"	"	.517.	38.26	Andrews. C. S. J. 1. 27.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Ethyl oxide.	$C_4 H_{10} O$.	.50342.	37.25	Favre and Silbermann. C. R. 23. 411.
" "	"	.61965067, 40°	45.85	{ Hirn. J. 20. 56.
" "	"	.66128878, 70°	48.93	
" "	"	.71586594, 100°	52.97	
" "	"	.79512984, 130°	58.83	
Amyl "	$C_{10} H_{22} O$.	.52117.	82.34	Favre and Silbermann. C. R. 23. 411.
Formic acid.	$C H_3 O_2$.	.536, 25°-45°.	24.66	Kopp. 16.
" "	"	.60401.	27.78	Favre and Silbermann. C. R. 23. 411.
Acetic "	$C_2 H_4 O_2$.	.4587, 5°-10°.	27.52	{ Regnault. 18.
" "	"	.4599, 10°-15°.	27.59	
" "	"	.4618, 15°-20°.	27.71	
" "	"	.509, 24°-45°.	30.54	Kopp. 16.
" "	"	.50822.	30.49	Favre and Silbermann. C. R. 23. 411.
Butyric acid.	$C_4 H_8 O_2$.	.503, 21°-45°.	44.26	Kopp. 16.
" "	"	.41420.	36.45	Favre and Silbermann. C. R. 23. 411.
Valeric "	$C_5 H_{10} O_2$.	.47857.	58.81	Favre and Silbermann. C. R. 23. 411.
Ethyl formate.	$C_3 H_6 O_2$.	.513, 20°-39°.	37.96	Kopp. 16.
" "	"	.485, m. of 3.	36.29	Andrews. C. S. J. 1. 27.
Methyl acetate.	$C_3 H_6 O_2$.	.507, 21°-41°.	37.52	Kopp. 16.
Ethyl "	$C_4 H_8 O_2$.	.496, 21°-45°.	43.65	" "
" "	"	.474, m. of 2.	41.71	Andrews. C. S. J. 1. 27.
" "	"	.48344.	42.54	Favre and Silbermann. J. 6. 78.
Methyl butyrate.	$C_5 H_{10} O_2$.	.487, 21°-45°.	49.67	Kopp. 16.
" "	"	.49176.	50.16	Favre and Silbermann. J. 6. 78.
Methyl valerate.	$C_6 H_{12} O_2$.	.491, 21°-45°.	56.96	Kopp. 16.
Ethyl oxalate.	$C_4 H_8 O_4$.	.4629, 5°-10°.	67.58	{ Regnault. 18.
" "	"	.4521, 10°-15°.	66.01	
" "	"	.4554, 15°-20°.	66.49	
" "	"	.457.	66.72	Andrews. C. S. J. 1. 27.
Acetone.	$C_3 H_6 O$.	.530, 20°-41°.	30.74	Kopp. 16.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Succinic acid.	$C_4 H_4 O_4$.	.313.	36.93	Kopp. 84.
Tartaric "	$C_4 H_4 O_6$.	.288.	43.20	" "
Racemic "	$C_4 H_4 O_6 H_2 O$.	.319.	53.59	" "
Cane sugar.	$C_{12} H_{22} O_{11}$.	.301. Crystallized.	102.94	" "
" "	"	.342. Amorphous.	116.96	" "
Mannite.	$C_6 H_{14} O_6$.	.324.	58.97	" "
Olive oil.		.504.		Delarive & Marcet. 10.
Beeswax.		.39, -20° to +2°		{ Person. 15. [176.
"		.52, 6°-26°		
"		.79, 26°-42°		
"		.72, 42°-58°		
"		.54, 66°-102°		
Sperm oil.		.45838.		Joule. P. M. (3). 81.
Milk.		.847.}		{ Fleischmann. C. S. J. (2). 13. 278.
Cream.		.780.}		

XIX. SALTS OF ORGANIC ACIDS.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Barium formate.	$Ba C_2 H_2 O_4$.	.143.	32.46	Kopp. 84.
Potassium quaxalate.	$K H_2 C_4 O_6 \cdot 2 H_2 O$.	.283.	71.91	" "
" oxalate. Neutral.	$K_2 C_2 O_4 \cdot H_2 O$.	.236.	43.47	" "
" tartrate. Acid.	$K H. C_4 H_4 O_6$.	.257.	48.34	" "
Seignette salt.	$KNaC_4 H_4 O_6 \cdot 4 H_2 O$.	.328.	108.27	" "
Calcium malate. Acid.	$Ca C_4 H_4 O_6 \cdot 4 H_2 O$.	.338.	82.81	" "

XX. MISCELLANEOUS ORGANIC COMPOUNDS.

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Nitrobenzol.	$C_6 H_5 N O_2$.	.3524, 5°-10°	43.34	{ Regnault. 18.
"	"	.3478, 10°-15°	42.78	
"	"	.3499, 15°-20°	43.04	
Mercaptan.	$C_2 H_6 S$.	.4715, 5°-10°	29.23	{ Regnault. 18.
"	"	.4653, 10°-15°	28.85	
"	"	.4772, 15°-20°	29.59	

Name.	Formula.	Specific Heat.	Molec Heat.	Authority.
Allyl sulphocyanide.	$C_4 H_5 N S$.	.432, 23°-48.°	42.77	Kopp. 16.
Ethyl bromide.	$C_2 H_5 Br$.	.2164, 5°-10.°	23.59	{ Regnault. 13.
" "	"	.2135, 10°-15.°	23.27	
" "	"	.2153, 15°-20.°	23.47	
" iodide.	$C_2 H_5 I$.	.1587, 5°-10.°	24.76	{ Regnault. 13.
" "	"	.1584, 10°-15.°	24.71	
" "	"	.1584, 15°-20.°	24.71	
" "	"	.1574, 5°-10.°	24.55	
" "	"	.1556, 10°-15.°	24.27	
" "	"	.1569, 15°-20.°	24.48	

XXI. AQUEOUS SOLUTIONS.*

Solution.	Specific Heat.	Authority.
Hydrogen chloride.		
H Cl + 6.25 aq.	.6687.	{ Marignac. 42.
" " 12.50 "	.7881.	
" " 25 "	.8787.	
" " 50 "	.9336.	
" " 100 "	.9650.	
" " 200 "	.9835.	
" " 10 "	.749.	{ Thomsen. P. A. 142. 337.
" " 20 "	.855.	
" " 50 "	.932.	
" " 100 "	.946.	
" " 200 "	.979.	
Sodium chloride.		
5 per cent solution.	.9306.	{ Schüller. 37.
10 " "	.8909.	
15 " "	.8606.	
20 " "	.8690.	
25 " "	.8079.	
30 " "	.7897.	
33.6 " "	.7752.	
35 " "	.7713.	

* For the specific heat of solutions of mixed salts, see Winkelmann, P. A. 149. 492.

Solution.	Specific Heat.	Authority.
Na Cl + 12.5 aq.	.8100.	{ Marignac. 42.
" " 25 "	.8760.	
" " 50 "	.9280.	
" " 100 "	.9596.	
" " 200 "	.9782.	
" " 10 "	.791.	{ Thomsen. P.A. 142. 337.
" " 20 "	.863.	
" " 30 "	.895.	
" " 50 "	.931.	
" " 100 "	.962.	
" " 200 "	.978.	{ Andrews. P. M. (3). 36. 515.
100 parts water to 29.215 salt.	.8018.	
" " " 14.607 "	.8671.	
3.09 per cent. solution.	.9638.	
5.15 " "	.9449.	
11.05 " "	.8925.	{ Winkelmann. P.A. 149. 1.
17.12 " "	.8526.	
26.03 " "	.8072.	
Potassium chloride.		
4 per cent. solution.	.9558.	{ Schüller. 37.
8 " "	.9140.	
12 " "	.8876.	
16 " "	.8503.	
20 " "	.8195.	
24 " "	.7935.	
28 " "	.7680.	
32 " "	.7486.	{ Thomsen. P. A. 142. 337.
K Cl + 15 aq.	.761.	
" " 30 "	.850.	
" " 50 "	.904.	
" " 100 "	.948.	
" " 200 "	.970.	{ Winkelmann. P. A. 149. 1.
3.04 per cent. solution.	.9625.	
4.22 " "	.9500.	
5.58 " "	.9341.	
8.77 " "	.9041.	
11.60 " "	.8773.	
15.60 " "	.8448.	
20.20 " "	.8078.	
25.20 " "	.7760.	
29.40 " "	.7529.	

Solution.	Specific Heat.	Authority.
Ammonium chloride.		
10 per cent. solution.	.9100.	{ Schüller. 37.
20 " "	.8403.	
30 " "	.7946.	
37 " "	.7644.	
NH ₄ Cl + 7.5 aq.	.760.	{ Thomsen. P. A. 142. 337.
" " 10 "	.778.	
" " 25 "	.881.	
" " 50 "	.937.	
" " 100 "	.966.	
" " 200 "	.982.	{ Winkelmann. P. A. 149. 1.
3.03 per cent. solution.	.9645.	
5.71 " "	.9341.	
9.98 " "	.8997.	
14.99 " "	.8574.	
25.00 " "	.8003.	
Calcium chloride.		
Ca Cl ₂ + 200 aq.	.957.	Thomsen. P. A. 142. 337.
Barium chloride.		
Ba Cl ₂ + 200 aq.	.932.	Thomsen. P. A. 142. 337.
Potassium bromide.		
K Br + 200 aq.	.962.	Thomsen. P. A. 142. 337.
Ammonium bromide.		
NH ₄ Br + 200 aq.	.968.	Thomsen. P. A. 142. 337.
Sodium iodide.		
10 per cent. solution.	.9135.	{ Schüller. 37.
20 " "	.8408.	
30 " "	.7811.	
40 " "	.7343.	
Na I + 200 aq.	.954.	Thomsen. P. A. 142. 337.
Potassium iodide.		
KI + 200 aq.	.950.	Thomsen. P. A. 142. 337.
Ammonium iodide.		
NH ₄ I + 200 aq.	.963.	Thomsen. P. A. 142. 337.
Sodium hydrate.		
Na HO + 7.5 aq.	.847.	{ Thomsen. P. A. 142. 337.
" " 15 "	.878.	
" " 30 "	.919.	
" " 50 "	.942.	
" " 100 "	.968.	
" " 200 "	.983.	

Solution.	Specific Heat.	Authority.
Potassium hydrate.		
K H O + 30 aq.	.876.	{ Thomsen. P.A. 142. 337.
" " 50 "	.916.	
" " 100 "	.954.	
" " 200 "	.975.	
Ammonium hydrate.		
NH ₄ HO + 30 aq.	.997.	{ Thomsen. P. A. 142. 337.
" " 50 "	.999.	
" " 100 "	.999.	
Sulphuric acid.*		
H ₂ SO ₄ + 4 aq.	.545.	{ Thomsen. P.A. 142. 337.
" " 9 "	.700.	
" " " "	.701.	
" " 19 "	.821.	
" " 49 "	.918.	
" " " "	.919.	
" " 99 "	.956.	
" " 199 "	.977.	
Nitric acid.		
H NO ₃ + 10 aq.	.768.	{ Thomsen. P.A. 142. 337.
" " 20 "	.849.	
" " 50 "	.930.	
" " 100 "	.963.	
" " 200 "	.982.	
Sodium sulphate.		
10 per cent. solution.	.9253.	{ Schüller. 37.
15 " "	.8959.	
20 " "	.8704.	
25 " "	.8523.	
80 " "	.8320.	
40 " "	.8074.	{ Marnagac. 42.
Na ₂ SO ₄ + 50 aq.	.8890.	
" " 100 "	.9345.	
" " 200 "	.9625.	
" " 400 "	.9815.	{ Thomsen. P.A. 142. 337.
Na ₂ SO ₄ + 65 aq.	.892.	
" " 100 "	.920.	
" " 200 "	.955.	

* Compare in Table number V.

Solution.	Specific Heat.	Authority.
Sodium hydrogen sulphate. Na H SO ₄ + 25 aq.	.8683.	{ Marignac. 42.
" " 50 "	.9146.	
" " 100 "	.9497.	
" " 200 "	.9719.	
Potassium sulphate. K ₂ SO ₄ + 200 aq.	.940.	Thomsen. P. A. 142. 337.
Ammonium sulphate. (NH ₄) ₂ SO ₄ + 30 aq.	.820.	{ Thomsen. P.A. 142. 337.
" " 50 "	.871.	
" " 100 "	.924.	
" " 200 "	.959.	
Ferrous sulphate. Fe SO ₄ + 200 aq.	.951.	Thomsen. P. A. 142. 337.
Copper sulphate. Cu SO ₄ + 200 aq.	.953.	Thomsen. P. A. 142. 337.
Zinc sulphate. Zn SO ₄ + 200 aq.	.947.	Thomsen. P. A. 142. 337.
Magnesium sulphate. Mg SO ₄ + 20 aq.	.744—.745.	{ Thomsen. P.A. 142. 337.
" " 50 "	.855—.859.	
" " 100 "	.917.	
" " 200 "	.952.	
Sodium nitrate. 10 per cent. solution.	.9320.	{ Schüller. 37.
20 " "	.8768.	
30 " "	.8341.	
40 " "	.7998.	
50 " "	.7673.	
100 parts water to 42.49 of salt.	.7838.	{ Andrews. P. M. (3). 36. 514.
" " " 21.245 "	.8585.	
" " " 10.622 "	.9131.	{ Thomsen. P.A. 142. 337.
Na NO ₃ + 10 aq.	.769.	
" " 25 "	.863.	
" " 50 "	.918.	
" " 100 "	.950.	
" " 200 "	.975.	

Solution.	Specific Heat.	Authority.
3.03 per cent. solution.	.9707.	Winkelmänn. P. A. 149. 1.
3.73 " "	.9658.	
4.81 " "	.9523.	
5.62 " "	.9442.	
8.40 " "	.9234.	
11.36 " "	.9025.	
16.64 " "	.8700.	
19.19 " "	.8559.	
25.03 " "	.8417.	
31.29 " "	.8153.	
40.06 " "	.7820.	
49.98 " "	.7576.	
57.97 " "	.7376.	
70.09 " "	.7121.	
Potassium nitrate.		
10 per cent. solution.	.9182.	Schüller. 37.
20 " "	.8589.	
30 " "	.8090.	
K NO ₃ + 25 aq.	.832.	Thomsen. P.A. 142. 337.
" " 50 "	.901.	
" " 100 "	.942.	
" " 200 "	.966.	
100 parts water to 25.29 of salt.	.8135.	At about 18°
" " " 12.645 "	.8915.	
" " " 6.322 "	.9369.	
3.05 per cent. solution.	.9673.	Winkelmänn. P.A. 149.1
4.15 " "	.9575.	
5.62 " "	.9458.	
8.40 " "	.9206.	
11.11 " "	.8997.	
15.31 " "	.8721.	
19.80 " "	.8484.	
Ammonium nitrate.		
NH ₄ NO ₃ + 5 aq.	.696—.699.	Thomsen. P.A. 142. 337.
" " 20 "	.859.	
" " 50 "	.929.	
" " 100 "	.962.	
3.04 per cent. solution.	.9654.	Winkelmänn. P.A. 149.1.
10.01 " "	.9208.	
20.00 " "	.8606.	
30.00 " "	.8774.	
40.00 " "	.7227.	
Barium nitrate.		
Ba N ₂ O ₆ + 200 aq.	.933.	Thomsen. P. A. 142. 337.

Solution.	Specific Heat.	Authority.
Lead nitrate. Pb N ₂ O ₆ + 200 aq. " " " "	.919. } .920. }	{ Thomsen. P.A. 142. 337.
Sodium carbonate. Na ₂ CO ₃ + 50 aq. " " 100 " " " 200 "	.896. } .933. } .958. }	{ Thomsen. P.A. 142. 337.
Sodium acetate. Na C ₂ H ₃ O ₂ + 20 aq. " " 50 " " " 100 " " " 200 "	.884. } .938. } .965. } .983. }	{ Thomsen. P.A. 142. 337.
Cane sugar. C ₁₂ H ₂₂ O ₁₁ + 25 aq. " " 50 " " " 100 " " " 200 " " " 400 "	.7558. } .8425. } .9091. } .9500. } .9742. }	{ Marignac. 42.
Tartaric acid. C ₄ H ₆ O ₆ + 10 aq. " " 25 " " " 50 " " " 100 " " " 200 "	.745. } .856. } .911. } .952. } .975. }	{ Thomsen. P. A. 142. 337.

XXII. SOLUTIONS IN CARBON DISULPHIDE.

Solution.	Specific Heat.	Authority.
Bromine. Br + C S ₂ .	.174.	Marignac. 42.
Iodine. I + 10 C S ₂ . " " 20 "	.219. } .228. }	{ Marignac. 42.
Sulphur. S + C S ₂ . " " 2 C S ₂ . " " 4 " " " 10 "	.229. } .232. } .232. } .235. }	{ Marignac. 42.

Solution.	Specific Heat.	Authority.
Phosphorus.		
P + $\frac{1}{2}$ CS ₂ .	.219.	{ Marignac. 42.
" " $\frac{1}{2}$ "	.222.	
" " 1 "	.225.	
" " 2 "	.229.	
" " 4 "	.2295.	

XXIII. LIQUID MIXTURES.

Mixture.	Specific Heat.	Authority.
Methyl alcohol and water.		
10 per cent. of C ₂ H ₅ O.	.98582.	{ Dupré. P. A. 148. 236.
20 " " "	.95914.	
30 " " "	.92658.	
40 " " "	.89219.	
50 " " "	.84645.	
60 " " "	.80177.	
70 " " "	.75500.	
80 " " "	.69999.	
90 " " "	.64282.	
Ethyl alcohol and water.		
1 volume alcohol + 9 vol. aq.	.9897.	{ Schnidaritsch. Wien Ak. 38. 39.
2 " " " 8 " "	.9835.	
3 " " " 7 " "	.9732.	
4 " " " 6 " "	.9482.	
5 " " " 5 " "	.9230.	
6 " " " 4 " "	.8456.	
7 " " " 3 " "	.8198.	
8 " " " 2 " "	.7784.	
9 " " " 1 " "	.7178.	
8.4 per cent. of C ₂ H ₅ O.	1.060.	{ Jamin & Amaury. C. R. 70. 1237.
17 " " "	1.065.	
25 " " "	1.055.	
34 " " "	1.030.	
50 " " "	.940.	
67 " " "	.840.	
84 " " "	.720.	

Mixture.	Specific Heat.	Authority.
5 per cent. of alcohol.	1.01502.	Dupré and Page. 38.
10 " "	1.03576.	
20 " "	1.04362.	
30 " "	1.02602.	
36 " "	.99900.	
40 " "	.96805.	
45 " "	.94192.	
50 " "	.90633.	
60 " "	.84332.	
70 " "	.78445.	
80 " "	.71690.	
90 " "	.65764.	
14.90 " "	1.0391.	25°. Schüller. See 39.
20.00 " "	1.0456.	
22.56 " "	1.0436.	
28.56 " "	1.0354.	
35.32 " "	1.0076.	
44.45 " "	.9610.	
49.46 " "	.9162.	
49.93 " "	.9096.	
54.09 " "	.8826.	
54.45 " "	.8793.	
58.17 " "	.8590.	
73.90 " "	.7771.	
83.00 " "	.7168.	
10 per cent. of alcohol.	1.0268.	0°. Winkelmann. 44.
20 " "	1.0401.	
30 " "	1.0106.	
40 " "	.9726.	
50 " "	.9061.	
60 " "	.8446.	
70 " "	.7813.	
80 " "	.7116.	
90 " "	.6448.	
Alcohol and benzol.		
20.43 per cent. of alcohol.	.5022.	Schüller. See 39.
24.45 " "	.5112.	
32.54 " "	.5268.	
48.74 " "	.5465.	
57.85 " "	.5565.	
66.89 " "	.5668.	
80.15 " "	.5862.	

Mixture.	Specific Heat.	Authority.
10 per cent. of alcohol.	.5502.	{ Winkelmann. 44.
20 " "	.5572.	
30 " "	.5594.	
40 " "	.5630.	
60 " "	.5654.	
70 " "	.5643.	
80 " "	.5660.	
90 " "	.5700.	
Alcohol and carbon disulphide.		
16.04 per cent. of alcohol.	.3371.	{ Schüller. See 39.
20.06 " " "	.3560.	
30.06 " " "	.3989.	
35.00 " " "	.4133.	
40.53 " " "	.4237.	
48.64 " " "	.4471.	
59.30 " " "	.4808.	
70.90 " " "	.5138.	
20 " " "	.3474.	{ Winkelmann. 44.
30 " " "	.3662.	
40 " " "	.4058.	
50 " " "	.4340.	
60 " " "	.4558.	
70 " " "	.4833.	
80 " " "	.5164.	
90 " " "	.5460.	
Alcohol and chloroform.		
16.75 per cent. of alcohol.	.3348.	{ Schüller. See 39.
28.77 " " "	.3999.	
33.92 " " "	.4130.	
39.78 " " "	.4315.	
47.00 " " "	.4539.	
56.46 " " "	.4841.	
72.80 " " "	.5331.	
Benzol and carbon disulphide.		
10 per cent. of benzol.	.2858.	{ Winkelmann. 44.
20 " " "	.3098.	
30 " " "	.3347.	
50 " " "	.3871.	
60 " " "	.4146.	
70 " " "	.4424.	
80 " " "	.4702.	
90 " " "	.4973.	

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SMITHSONIAN MISCELLANEOUS COLLECTIONS.

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THE

CONSTANTS OF NATURE.

PART III.

TABLES OF EXPANSION BY HEAT

FOR

SOLIDS AND LIQUIDS.

COMPILED BY

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THE following is the *third* part of a general work on the "CONSTANTS OF NATURE," prepared gratuitously for the Smithsonian Institution by Professor F. W. Clarke, and published at the expense of its fund.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, APRIL, 1876.

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INTRODUCTION.

IN the following tables will be found data for the expansion by heat of about three hundred and fifty different substances. In every case the coefficient for one degree is given, a rule which involved many tedious reductions during the process of compilation. It will be noticed that the linear and cubical coefficients are collected separately. This has been so arranged in order to avoid confusion. It would have been easy for the compiler to have given in many cases either the cubical coefficient or the linear coefficient by itself, leaving it to the reader to multiply or to divide by three in order to obtain the other value. But this would have manifestly involved great inaccuracies, since the cubical coefficient is not in every case exactly treble the linear. Accordingly the compiler has in no instance given a cubical value deduced by himself from a linear, or *vice versa*. Every determination given must rest solely upon the original authority of the experimenter. For errors involved in reducing to the single centigrade degree the compiler is alone responsible.

One difficulty was encountered in dealing with the expansion rates of liquids; namely, that the data given were often too full for incorporation in tables such as these. For instance: in most of Kopp's determinations, the volume of each liquid is given at many temperatures, say at every five degrees from 0° up to 100° and over. In some cases, even, determinations are given for every degree. In such instances the compiler has simply selected from the list the values at two, three, or four salient temperatures, and has referred to the original paper for the rest.

For these tables absolute completeness cannot be claimed. Nothing will be found in them relating to the expansion of liquid mixtures or of solutions. In all other directions, however, it is hoped that they will prove practically complete, at least up to January 1st, 1876.

F. W. C.

A LIST

OF SOME IMPORTANT PAPERS UPON EXPANSION.

1. DULONG AND PETIT.—“Recherches sur la mesure des températures, et sur les lois de la communication de la chaleur.” *Ann. Chim. Phys.* (2). 7. 113. 1818.
2. HÄLLSTRÖM. “Untersuchungen über die Volumensveränderungen, welche das Wasser durch die Wärme erleidet, und Bestimmung der Temperatur bei welche dasselbe seiner grösste Dichtigkeit besitzt.” *Pogg. Ann.* 1. 1824. p. 129. See also another paper in v. 9. 1827. p. 530.
3. MITSCHERLICH. “Ueber das Verhältniss der Form der krystallisirten Körper zur Ausdehnung durch die Wärme.” *Pogg. Ann.* 1. 125. 1824.
4. ERMAN. “Ueber den Einfluss der Liquefaction auf das Volumen und die Ausdehnbarkeit einiger Körper.” *Pogg. Ann.* 9. 557. 1827.
5. MITSCHERLICH. “Ueber die Ausdehnung der krystallisirten Körper durch die Wärme.” *Pogg. Ann.* 10. 137. 1827.
6. DANIELL. “On a new register-pyrometer, for measuring the expansion of solids, and determining the higher degrees of temperature upon the common thermometric scale.” *Phil. Trans.* 1830. 237.
7. DANIELL. “Further experiments with a new register-pyrometer for measuring the expansion of solids.” *Phil. Trans.* 1831. 443.
8. MUNCKE. “Ueber die Ausdehnung der tropfbaren Flüssigkeiten durch Wärme.” *Mem. Acad. St. Petersburg. Savans Etrang.* I. 249. 1831.
9. STAMPFER. “Versuche zur Bestimmung des absoluten Gewichts des Wassers, der Temperatur seiner grössten Dichtigkeit, und der Ausdehnung derselben.” *Pogg. Ann.* 21. 75. 1831.
10. MUNCKE. “Sur la dilatation de l'alcohol absolu et du carbure de soufre par la chaleur.” *Ann. Chim. Phys.* (2). 64. 5. 1837.
11. DESPRETZ. “Untersuchungen über das Maximum der Dichtigkeit bei Flüssigkeiten.” *Pogg. Ann.* 41. 58. 1837. *Compt. Rend.* 1837.
12. MITSCHERLICH. “Ueber die Bestimmung der Ausdehnung krystallisirten Körper durch die Wärme.” *Pogg. Ann.* 41. 213. 1837.

13. DESPRETZ. "Observations sur la dilatation du soufre." *Compt. Rend.* 7. 589. 1839.
14. DESPRETZ. "Recherches sur le maximum de densité de l'eau pure, et des dissolutions aqueuses." *Ann. Chim. Phys.* (2). 70. 5. 1839.
15. KOPP. "Recherches sur le volume spécifique." *Ann. Chim. Phys.* (3). 4. 462. 1842.
16. REGNAULT. "Note sur la dilation du verre." *Ann. Chim. Phys.* (3). 4. 64. 1842. *Pogg. Ann.* 55. 584.
17. KOPP. "Ueber den Zusammenhang zwischen der chemischen Constitution und einiger physikalischen Eigenschaften bei flüssigen Verbindungen." *Ann. Chem. Pharm.* 50. 71. 1844.
18. SALM-HORSTMAR. "Ueber die Ausdehnung des flüssigen Wassers unter dem Gefrierpunkt." *Pogg. Ann.* 62. 283. 1844.
19. BRUNNER. "Expériences sur la densité de la glace a différentes températures." *Ann. Chim. Phys.* (3). 14. 369. 1845.
20. PIERRE. "Recherches sur la dilatation des liquides." *Ann. Chim. Phys.* (3). 15. 325. 1845.
21. Continuation of 20. *Ann. Chim. Phys.* (3). 19. 193. 1847.
22. PLAYFAIR AND JOULE. "On atomic volume and specific gravity." *Chem. Soc. Memoirs.* 2. 401. 1845. Second paper, vol. 3. 57. 1848.
23. KOPP. "Untersuchungen über das specifische Gewicht, die Ausdehnung durch die Wärme, und den Siedpunkt einiger Flüssigkeiten." *Pogg. Ann.* 72. 1847. Two papers, pages 1. 223.
24. PIERRE. "Recherches sur les propriétés physiques des liquides, et en particulier sur leur dilatation." *Ann. Chim. Phys.* (3). 20. 5. 1847.
25. PIERRE. "Recherches sur la dilatation et sur quelques autres propriétés physiques de l'acide sulfureux anhydre et du sulfite d'oxyde d'ethyle." *Ann. Chim. Phys.* (3). 21. 336. 1847.
26. PIERRE. "Mémoire sur la thermométrie, et en particulier sur la comparaison du thermomètre à air avec les thermomètres à liquides." *Compt. Rend.* 27. 213. 1848. *Pogg. Ann.* 76. 458.
27. PLAYFAIR AND JOULE. "Researches upon atomic volume and specific gravity." *Journ. Chem. Soc.* 1. 1849. Two papers, pages 121, 139.
28. MILITZER. "Ueber die Ausdehnung des Quecksilbers durch die Wärme." *Pogg. Ann.* 80. 55. 1850.
29. PIERRE. "Recherches sur les propriétés physiques des liquides, et en particulier sur leur dilatation." *Ann. Chim. Phys.* (3). 31. 118. 1851.
30. PIERRE. "Recherches sur la dilatation." *Ann. Chim. Phys.* (3) 33. 199. 1851.
31. KOPP. "Ueber die Ausdehnung einiger fester Körper durch die Wärme." *Ann. Chem. Pharm.* 81. 1. 1852. *Pogg. Ann.* 86. 156.

32. FRANKENHEIM "Ueber das Volumen des Wassers bei verschiedenen Temperaturen, nach Is. Pierre's Beobachtungen." Pogg. Ann. 86. 451. 1852.
33. HAGEN. "Ueber die Ausdehnung des destillirten Wassers unter verschiedenen Wärmegraden." Abhandl. Akad. d. Wiss. Berlin. 1855.
34. KOPP. "Beiträge zur Stöchiometrie der physikalischen Eigenschaften chemischer Verbindungen." Ann. Chem. Pharm. 96. 1855. Three papers, pages 1. 153. 303.
35. KOPP. "Untersuchungen über das specifische Gewicht, die Ausdehnung durch die Wärme, und den Siedpunkt einiger Flüssigkeiten." Ann. Chem. Pharm. 94, 257. 95, 307. 98, 367. 1855-6.
36. KOPP. "Ueber die specifische Volume der Stickstoffhaltigen Verbindungen." Ann. Chem. Pharm. 100. 19. 1856.
37. PFAFF. "Untersuchungen über die Ausdehnung der Krystalle durch die Wärme." Pogg. Ann. 104. 171. 1858. Second paper, v. 107. 148.
38. DRION. "Note sur la dilatabilité des liquides chauffés à des températures supérieures à celle de leur ebullition." Compt. Rend. 46. 1235. Pogg. Ann. 105. 158. 1858.
39. D'ANDRÉEFF. "Recherches sur le poids spécifique et la dilatation par la chaleur de quelques gaz condensés." Ann. Chim. Phys. (3). 56. 317. 1859.
40. SORBY. "On the expansion of water and saline solutions at high temperatures." Phil. Mag. (4). 18. 81. 1859.
41. HAHN. "On the expansion of crystalline bodies by heat." Phil. Mag. (4). 18. 155. 1859.
42. MENDELEJEFF. "Notiz über die Ausdehnung homologer Flüssigkeiten." Ann. Chem. Pharm. 114. 165. 1860.
43. MENDELEJEFF. "Ueber die Ausdehnung der Flüssigkeiten beim Erwärmen über ihren Siedepunkt." Ann. Chem. Pharm. 119. 1. 1861.
44. CALVERT, JOHNSON, AND LOWE. "On the expansion of metals and alloys." Chem. News. 3. 1861. Pages 315, 357, 371.
45. DUVERNOY. "Ueber die Ausdehnung des Wassers beim Gefrieren." Pogg. Ann. 117. 454. 1862.
46. FIZEAU. "Recherches sur la dilatation et la double réfraction du cristal de roche chauffé." Ann. Chim. Phys (4). 2. 143. 1864.
47. FIZEAU. "Sur la dilatation du diamant et du protoxyde du cuivre cristallisé sous l'influence de la chaleur." Compt. Rend. 60. 1161. 1865.
48. WEIDNER. "Die Ausdehnung des Wassers bei Temperaturen unter 4° R." Pogg. Ann. 129. 300. 1866.
49. FIZEAU. "Mémoire sur la dilatation des corps solides par la chaleur." Ann. Chim. Phys. (4). 8. 335. 1866.

- 50. MATTHIESSEN. "On the expansion by heat of water and mercury." Phil. Trans. 1866. 231.
- 51. MATTHIESSEN. "On the expansion by heat of metals and alloys." Phil. Trans. 1866. 861. Pogg. Ann. 130. 50.
- 52. HIRN. "Mémoire sur la thermodynamique. Recherches expérimentales sur la dilatation et sur la capacité calorifique à des hautes températures de quelques liquides très-volatiles." Ann. Chim. Phys. (4). 10. 32. 1867.
- 53. ROSSETTI. "Sur le maximum de densité et la dilatation de l'eau distillée." Ann. Chim. Phys. (4). 10. 461. 1867. Second paper, v. 17, 370. 1869.
- 54. LOUGUININE. "Étude des densités et dilatations de la benzine et de ses homologues." Ann. Chim. Phys. (4). 11. 453. 1867.
- 55. FIZEAU. "Sur la propriété que possède l'iode d'argent de se contracter par la chaleur et de se dilater par le froid." Compt. Rend. 64. 314. 1867. Another paper, same vol., p. 771.
- 56. FIZEAU. "Tableau des dilatations par la chaleur de divers corps simples métalliques ou non métalliques, et de quelques composés hydrogènes du carbone." Compt. Rend. 68. 1125. 1869.

EXPLANATORY NOTES.

In the following tables the coefficients of expansion given are always the coefficients for *one degree Centigrade*. When the coefficient is followed by one temperature, as, .00001188.40°, it is the *true* coefficient at that temperature. When two temperatures are appended, as, .0001105, 0°-100°, the coefficient is the mean value for any one degree between them.

But few abbreviations, save in the references to original papers, have been used. The letters S. or L., affixed to the name of a substance, indicate that it is either solid or liquid, as the case may be. The minus sign prefixed to a coefficient, indicates that the letter represents *contraction*, instead of expansion.

The following abbreviations are employed in referring to sources of information, original papers, &c. A single number attached to the name of an authority, refers to the paper bearing that number in the list accompanying the tables. References to periodicals are followed by numbers giving (when necessary) the series, volume, and page.

Am. Chem. "American Chemist."

A. C. P. "Annalen der Chemie und Pharmacie."

A. C. Phys. "Annales de Chimie et de Physique."

Baier Akad, Phys. Abhandl. "Baierisches Akademie. Physikalische Abhandlungen."

B. D. C. G. "Berichte der Deutschen Chemischen Gesellschaft."

B. S. C. "Bulletin de la Société Chimique."

C. S. J. "Journal of the Chemical Society."

Gilb. Ann. "Gilbert's Annalen."

Gren's J. "Gren's Journal."

J. "Jahresbericht für Chemie."

J. F. P. "Journal für Praktische Chemie."

P. A. "Poggendorf's Annalen."

P. M. "Philosophical Magazine."

P. T. "Philosophical Transactions."

W. D. "Watt's Dictionary."

Young's Nat. Phil. "Young's Natural Philosophy."

A TABLE OF LINEAR EXPANSIONS.

I. ELEMENTARY SUBSTANCES.

Name.	Coeff. of Expansion.	Authority.
Hydrogen.		
Fluorine.		
Chlorine.		
Bromine. See cubical table.		
Iodine. " "		
Lithium.		
Sodium.		
Potassium.		
Rubidium.		
Caesium.		
Silver. See also cubical table.	.00002120. 0°-100°	Muschenbroek. W. D. 3. 68.
"	.000021000. "	Ellicot. "
"	.000018900. "	Herbert. "
"	.0000208260. "	Troughton. "
" Cupelled.	.0000190974. "	{ Lavoisier & Laplace. W. D. 3. 68.
" Paris standard.	.0000190868. "	
"	.0000198870. "	Guyton-Morveau. A. C. Phys. 90. 237.
"	.000019496. 16°.6-100°. }	Daniell 7.
"	.000020657. 16°.6-350°. }	
"	.000020488. 16°.6-1024°. }	
"	.000019100. 0°-100°. }	
"	.000019900. "	Kupffer. P. A. 86. 310.
"	.00001943. "	Calvert, Johnson & Lowe.
" Cast.	.00001921. At 40°.	Matthiessen. 51. [44.
Thallium.	.00003021. At 40°.	Fizeau. 56. " "
Oxygen.		
Sulphur. Sicily.	.00006413. At 40°.	Fizeau. 56.
" See also cubical table.		" "
Selenium. Cast.	.00003680. "	" "
Tellurium. "	.00001675. "	" "
Lead. See also cubical table.	.00002867. 0°-100°.	Smeaton. W. D. 3. 68.
"	.0000284836. "	Lavoisier & Laplace. W. D. 3. 68.
"	.0000271948. "	Guyton-Morveau. A. C. Phys. 90. 237.

Name.	Coëff. of Expansion.	Authority.
Lead.	.0000290.	Horner. } See 31.
"	.0000295.	Prinsep. }
"	.00002785. 16°.6-100°. }	Daniell. 7.
"	.00002968. 16°.6-322°. }	
"	.0000301. 0°-100°.	Calvert, Johnson & Lowe.
"	.00002799. "	Matthiessen. 51. [44.
"	.00002924. At 40°.	Fizeau. 56.
Calcium.		
Strontium.		
Barium.		
Chromium.		
Manganese.		
Iron. See cubical table.	.00001156. 0°-100°.	Borda. W. D. 3. 68.
"	.00001258. "	Smeaton. "
" Wire.	.000014401. "	Troughton. "
" Forged.	.0000122045. "	Lavoisier & Laplace. W.
" Wire drawn.	.0000123504. " }	D. 3. 68.
"	.0000109980. "	Guyton-Morveau. A. C.
"		Phys. 90. 237.
"	.0000118203. "	Dulong & Petit. W. D. 3. 68.
"	.00001179. 16°.6-100°. }	Daniell. 7.
"	.00001344. 16°.6-350°. }	
"	.000011900. 0°-100°.	Calvert, Johnson & Lowe.
" Red. by H. Com-		[44.
pressed.	.00001188. }	
" Forelectromagnet	.00001210. 40°.	{ Fizeau. 56.
" Meteoric. Caille.	.00001095. }	
Steel. Annealed.	.000012200. 0°-100°. }	Muschenbroek. W. D.
" Tempered.	.000013700. "	3. 68.
" Hard.	.0000122500. "	Smeaton. W. D. 3. 68.
" Blistered.	.0000115000. "	" "
"	.000011898. "	Troughton. W. D. 3. 68.
"	.000011899. "	
" Not tempered.	.0000107875. "	
" " "	.0000107956. "	
" Tempered yellow.	.0000136900. "	Lavoisier & Laplace. W.
" " "	.0000138600. "	D. 3. 68.
" Tempered at high	.0000123956. "	
" [t°.	.000011447. "	Roy. W. D. 3. 68.
" Blistered.	.0000112500. "	Phil. Trans. 1795, p. 428.
" French cast. Tem-		
pered.	.00001322. }	
" French cast. An-	.00001101. 40°.	{ Fizeau. 56.
nealed.		
" English cast. An-	.00001095. }	
nealed.		

Name.	Coeff. of Expansion.	Authority.
Steel. Soft.	.0000103. 0°-100°.	Calvert, Johnson & Lowe.
Cast iron.	.0000111111. "	Lavoisier. W. D. 3. 68. [44.
" "	.0000110940. "	Roy. "
" "	.000010707. 16°.6-100°.	Daniell. 7. [44.
" "	.000011829. 16°.6-350°.	
" "	.000010829. 16°.6-1530°.	
" "	.0000112. 0°-100°.	
" " Gray.	.00001061. 40°.	Calvert, Johnson & Lowe.
Cobalt. Red. by H. Com-		Fizeau. 56.
pressed.	.00001236. 40°.	" "
Nickel. Red. by H. Com-		
pressed.	.00001279. 40°.	" "
Uranium.		
Copper. See also cubi-		
cal table.	.000019100. 0°-100°.	Muschenbroek. W. D. 3. 68.
"	.0000170.	Smeaton. See 31.
"	.0000178.	Borda. "
"	.000019188. 0°-100°.	Troughton. W. D. 3. 68.
"	.0000172244. "	Lavoisier & Laplace. W.
"	.0000171222. "	
"	.0000179013. "	D. 3. 68.
"		Guyton-Morveau. A. C.
"		Phys. 90. 237.
"	.0000171821. "	Dulong & Petit. W. D. 3. 68.
"	.0000171. "	Horner. See 31.
"	.0000169. "	Prinsep. "
"	.000017146. 16°.6-100°.	Daniell. 7.
"	.000019037. 16°.6-350°.	
"	.000022688. 16°.6-1091°.	
"	.00001866. 0°-100°.	
" Native. L. Supe-		Matthiessen. 51.
rior.	.00001690. } 40°.	{ Fizeau. 56.
" Commercial.	.00001678. }	
Ruthenium. Semi-fused.	.00000963. 40°.	Fizeau. 56.
Rhodium. "	.00000850. 40°.	" "
Palladium. See also cu-		
bical table.	.0000100000. 0°-100°.	Wollaston. W. D. 3. 68.
"	.00001104. "	Matthiessen. 51.
" Forged.	.00001176. 40°.	Fizeau. 56.
Platinum. See also cu-		
bical table.	.0000099180. 0°-100°.	Troughton. W. D. 3. 67.
"	.0000085655. "	Borda. "
"	.0000088420. "	Dulong & Petit. "
"	.0000085675. "	Guyton-Morveau. A. C.
"		Phys. 90. 237.
"	.0000088129. 16°.6-100°.	Daniell. 7. [44.
"	.0000089832. 16°.6-350°.	
"	.00000680. 0°-100°.	
		Calvert, Johnson & Lowe.

Name.	Coëff. of Expansion.	Authority.
Platinum.	.00000886. 0° - 100° .	Matthiessen. 51.
" Cast.	.00000899. 40° .	Fizeau. 56.
Iridium. "	.00000700. 40° .	" "
Osmium. Semi-fused.	.00000657. 40° .	" "
Molybdenum.		
Tungsten.		
Zinc. See cubical table.	.0000294200. 0° - 100° .	Smeaton. W. D. 3. 68.
" Hammered.	.0000301100. "	
"	.0000297.	
"	.0000306054. 0° - 100° .	
"	.00002973. $16^{\circ}.6$ - 100° .	Daniell. 7.
"	.00002558. $16^{\circ}.6$ - 350° .	
"	.00003192. $16^{\circ}.6$ - 412° .	
"	.00002200. 0° - 100° .	
"	.00002976. "	Calvert, Johnson & Lowe. 44.
" Distilled.	.00002918. 40° .	Matthiessen. 51.
Cadmium. See also cubical table.	.0000332. 0° - 100° .	Fizeau. 56.
"	.00003159. "	Calvert, Johnson & Lowe. 44.
" Distilled.	.00003069. 40° .	Matthiessen. 51.
Magnesium. Cast.	.00002694. 40° .	Fizeau. 56.
Mercury. See cubical table.		" "
Indium. Cast.	.00004170. 40° .	" "
Nitrogen.		
Boron.		
Phosphorus. See cubical table.		
Vanadium.		
Arsenic. Sublimed.	.00000559. 40° .	Fizeau. 56.
Antimony. See also cubical table.	.0000108300. 0° - 100° .	Smeaton. W. D. 3. 68.
"	.0000098. "	
"	.00001056. "	
" Following axis. } " Normal to " } " Mean value. } Crystal	.00001692. } .00000882. } 40° . .00001152. }	
Bismuth. See also cubical table.	.00001392. 0° - 100° .	Fizeau. 56.
"	.0000133. "	
		Smeaton. W. D. 3. 68.
		Calvert, Johnson & Lowe. 44.

Name.	Coëff. of Expansion.	Authority.
Bismuth.	.00001316. 0°-100°.	Matthiessen. 51.
" Following axis. } Crystal.	.00001621. }	{ Fizeau. 56.
" Normal to " }	.00001208. }	
" Mean value. }	.00001346. }	
Gold. Annealed.	.000014600. 0°-100°.	Muschenbroek. W. D. 3. 68.
"	.000015000. "	Ellicot. "
" Parted.	.0000146606. "	{ Lavoisier & Laplace. W. D. 3. 68.
" Paris standard. Unannealed.	.0000155155. "	
" Paris standard. Annealed.	.0000151361. "	
"	.0000147545. 0°-100°.	Guyton-Morveau. A. C. Phys. 90. 237.
"	.00001229. 16°.6-100°.	{ Daniell. 7.
"	.00001271. 16°.6-350°.	
"	.0000138. 0°-100°.	Calvert, Johnson & Lowe. 44.
"	.00001470. "	Matthiessen. 51.
" Cast.	.00001443. 40°.	Fizeau. 56.
See also cubical table.		
Carbon. Diamond.	.000000000. -38°.8.	{ Fizeau. 47.
" "	.000000562. 0°.	
" "	.000000707. 10°.	
" "	.000000852. 20°.	
" "	.000000997. 30°.	
" "	.000001142. 40°.	
" "	.000001286. 50°.	
" "	.00000118. 40°.	Fizeau. 56.
See also cubical table.		
" Graphite.	.000002925. 16°.6-100°.	{ Daniell. 7.
" "	.000002108. 16°.6-350°.	
" "	.00000786. 40°.	Fizeau. 56.
" Gas carbon.	.00000540. 40°.	" "
" Fir charcoal.	.0000125. 0°-80°.	{ Heinrich. Baier. Akad.
" Oak "	.0000150. "	{ Phys. Abhandl. 1806.
" Anthracite.	.00002078. 40°.	Fizeau. 56.
Silicon. Cast.	.00000763. 40°.	" "
Titanium.		
Tin. See also cubical table.	.0000284000. 0°-100°.	Muschenbroek. W. D. 3. 68.
" Grain.	.0000248300. "	Smeaton. W. D. 3. 68.
" Malacca.	.0000193765. "	{ Lavoisier & Laplace. W. D. 3. 68.
" English.	.0000217298. "	
"	.0000209.	Horner. See 31.

Name.	Coëff. of Expansion.	Authority.
Platinum.	.00000886. 0° - 100° .	Matthiessen. 51.
" Cast.	.00000899. 40° .	Fizeau. 56.
Iridium. "	.00000700. 40° .	" "
Osmium. Semi-fused.	.00000657. 40° .	" "
Molybdenum.		
Tungsten.		
Zinc. See cubical table.	.0000294200. 0° - 100° .	Smeaton. W. D. 3. 68.
" Hammered.	.0000301100. "	
"	.0000297.	Horner. See 31.
"	.0000306054. 0° - 100° .	Guyton-Morveau. A. C. Phys. 90. 237.
"	.00002973. $16^{\circ}.6$ - 100° .	Daniell. 7.
"	.00002558. $16^{\circ}.6$ - 350° .	
"	.00003192. $16^{\circ}.6$ - 412° .	
"	.00002200. 0° - 100° .	Calvert, Johnson & Lowe. 44.
"	.00002976. "	Matthiessen. 51.
" Distilled.	.00002918. 40° .	Fizeau. 56.
Cadmium. See also cubical table.	.0000332. 0° - 100° .	Calvert, Johnson & Lowe. 44.
"	.00003159. "	Matthiessen. 51.
" Distilled.	.00003069. 40° .	Fizeau. 56.
Magnesium. Cast.	.00002694. 40° .	" "
Mercury. See cubical table.		
Indium. Cast.	.00004170. 40° .	Fizeau. 56.
Nitrogen.		
Boron.		
Phosphorus. See cubical table.		
Vanadium.		
Arsenic. Sublimed.	.00000559. 40° .	Fizeau. 56.
Antimony. See also cubical table.	.0000108300. 0° - 100° .	Smeaton. W. D. 3. 68.
"	.0000098. "	
"	.00001056. "	Calvert, Johnson & Lowe. 44.
" Following axis.	.00001692. }	Matthiessen. 51.
" Normal to "	.00000882. }	{ Fizeau. 56.
" Mean value. } Crystal.	.00001152. }	
Bismuth. See also cubical table.	.00001392. 0° - 100° .	Smeaton. W. D. 3. 68.
"	.0000133. "	Calvert, Johnson & Lowe. 44.

Name.	Coëff. of Expansion.	Authority.
Bismuth.	.00001316. 0°-100°.	Matthiessen. 51.
" Following axis. } Crystal.	.00001621. }	{ Fizeau. 56.
" Normal to " }	.00001208. } 40°.	
" Mean value. }	.00001346. }	
Gold. Annealed.	.000014600. 0°-100°.	Muschenbroek. W.D. 3. 68.
" " "	.000015000. " "	Ellicot. "
" Parted.	.0000146606. " "	{ Lavoisier & Laplace. W. D. 3. 68.
" Paris standard. Unannealed.	.0000155155. " "	
" Paris standard. Annealed.	.0000151361. " "	
" " "	.0000147545. 0°-100°.	Guyton-Morveau. A. C. Phys. 90. 237.
" " "	.00001229. 16°.6-100°.	{ Daniell. 7.
" " "	.00001271. 16°.6-350°.	
" " "	.0000138. 0°-100°.	Calvert, Johnson & Lowe. 44.
" " "	.00001470. " "	Matthiessen. 51.
" Cast.	.00001443. 40°.	Fizeau. 56.
See also cubical table.		
Carbon. Diamond.	.000000000. -38°.8.	{ Fizeau. 47.
" " "	.000000562. 0°.	
" " "	.000000707. 10°.	
" " "	.000000852. 20°.	
" " "	.000000997. 30°.	
" " "	.000001142. 40°.	
" " "	.000001286. 50°.	
" " "	.00000118. 40°.	Fizeau. 56.
See also cubical table.		
" Graphite.	.000002925. 16°.6-100°.	{ Daniell. 7.
" " "	.000002108. 16°.6-350°.	
" " "	.00000786. 40°.	Fizeau. 56.
" Gas carbon.	.00000540. 40°.	" "
" Fir charcoal.	.0000125. 0°-80°.	{ Heinrich. Baier. Akad.
" Oak " "	.0000150. " "	{ Phys. Abhandl. 1806.
" Anthracite.	.00002078. 40°.	Fizeau. 56.
Silicon. Cast.	.00000763. 40°.	" "
Titanium.		
Tin. See also cubical table.	.0000284000. 0°-100°.	Muschenbroek. W. D. 3. 68.
" Grain.	.0000248300. " "	Smeaton. W. D. 3. 68.
" Malacca.	.0000193765. " "	{ Lavoisier & Laplace. W. D. 3. 68.
" English.	.0000217298. " "	
" " "	.0000209. " "	Horner. See 31.

Name.	Coëff. of Expansion.	Authority.
Tin.	.0000216382. 0°-100°.	Guyton-Morveau. A. C. Phys. 90. 237.
"	.00001764. 16°.6-100°.	{ Daniell. 7.
"	.00001796. 16°.6-228°.	
"	.0000273. 0°-100°.	Calvert, Johnson & Lowe. 44.
"	.00002296. "	Matthiessen. 51.
" Compressed powder	.00002234. 40°.	Fizeau. 56.
Zirconium.		
Glucinum.		
Aluminum. Commercial	.0000222. 0°-100°.	Calvert, Johnson & Lowe. 44.
" Cast.	.00002313. 40°.	Fizeau. 56.
Lanthanum.		
Didymium.		
Cerium.		
Yttrium.		
Erbium.		
Thorium.		
Niobium.		
Tantalum.		

II. FLUORIDES AND IODIDES.

Name.	Coëff. of Expansion.	Authority.
Fluor spar. Ca F ₂ .	.000019504. 0°-100.	Pfaff. 37.
Silver iodide. Ag I.	.00000166. Lengthwise.	{ Fizeau. 55. Second paper.
Cylinder. Precipitated and compressed.	.00000122. Transversely.	
	.00000137. Mean value.	
Mercuric iodide. Hg I ₂ .	.00002387. 40°.	Fizeau. 55. Second paper.
Lead " Pb I ₂ .	.00003359. 40°.	" " " "
Cadmium " Cd I ₂ .	.00002916. 40°.	" " " "

III. OXIDES AND SULPHIDES.

Name.	Coëff. of Expansion.	Authority.
Ice. H_2O .	.002941.	Heinrich. Baier. Akad. Phys. Abhandl. 1806.
Hematite. Fe_2O_3 .	.00000829. Following axis. } 40°	{ Fizeau. 49.
" "	.00000836. Normal to " }	
Magnetite. Fe_3O_4 .	.000009540. $0^\circ-100^\circ$.	Pfaff. 37.
Copper oxide. CuO .	— .000000095. 0° .	Fizeau. 47.
" " "	.000000000. $4^\circ.1$.	
" " "	.000000136. 10° .	
" " "	.000000367. 20° .	
" " "	.000000597. 30° .	
" " "	.000000828. 40° .	
" " "	.000001059. 50° .	
Zinc " ZnO .	.00000316. Following axis. } 40°	{ Fizeau. 49.
Zincite.	.00000539. Normal to " }	
Corundum. Al_2O_3 .	.0000068756. Longit. axis. } $0^\circ-100^\circ$	{ Pfaff. 37.
" "	.0000065513. Horiz. " }	
" "	.00000619. Following axis. } 40°	{ Fizeau. 49.
" "	.00000543. Normal to " }	
Quartz. SiO_2 .	.000008073. Longit. axis. } $0^\circ-100^\circ$	{ Pfaff. 37.
" "	.000015147. Horiz. " }	
" "	.00000692. 10° .	Fizeau. 46.
" "	.00000717. 20° .	
" "	.00000743. 30° .	
" "	.00000769. 40° .	
" "	.00000794. 50° .	
" "	.00001281. 10° .	Fizeau. 46.
" "	.00001316. 20° .	
" "	.00001350. 30° .	
" "	.00001385. 40° .	
" "	.00001420. 50° .	
" "	.00000781. Following axis. } 40°	{ Fizeau. 49.
" "	.00001419. Normal to " }	
Rutile. TiO_2 .	.00000919. Following axis. } 40°	{ Fizeau. 49.
" "	.00000714. Normal to " }	
Tinstone. SnO_2 .	.000004860. Longit. axis. } $0^\circ-100^\circ$	{ Pfaff. 37. Second paper.
" "	.000004526. Horiz. " }	
" "	.00000392. Following axis. } 40°	{ Fizeau. 49.
" "	.00000321. Normal to " }	

Name.	Coëff. of Expansion.	Authority
Pyrite. Fe S ₂ .	.000010084. 0°-100°.	Pfaff. 37.
Galena. Pb S.	.000018594. "	" "

IV. SULPHATES, CARBONATES, AND PHOSPHATES.

Name.	Coëff. of Expansion.	Authority.
Gypsum. Ca S O ₄ . 2 H ₂ O.	.000015589. 0°-100°.	{ Pfaff. 37. Second paper
" "	.000036278. For three axes at	
" "	.000022752. right angles.	
Celestine. Sr S O ₄ .	.000019205. Lesser horiz.	{ Pfaff. 37. Second paper.
" "	.000018513. Greater "	
" "	.000014903. Vertical.	
Barite. Ba S O ₄ .	.000014311. Lesser horiz.	{ Pfaff. 37. Second paper.
" "	.000022519. Greater "	
" "	.000014904. Vertical.	
Calcite. Ca C O ₃ .	.000026261. Longit. axis.	{ Pfaff. 37.
" "	— .0000031054. Horiz. "	
" "	.000003076. Mean value.	
Arragonite. "	.000010781. Lesser horiz.	{ Pfaff. 37. Second paper.
" "	.000015903. Greater "	
" "	.000031358. Vertical.	
Chalybite. Fe C O ₃ .	.000016133. Longit. axis.	{ Pfaff. 37. Second paper.
"	.000005388. Horiz. "	
Apatite.	.000011254. Longit. axis.	{ Pfaff. 37. Second paper.
"	.000010006. Horiz. "	

V. SILICATES.

Name.	Coëff. of Expansion.	Authority.
Beryl.	.0000017214. Longit. axis.	{ Pfaff. 37.
"	— .0000001316. Horiz. "	
" Emerald.	.00000106. Following axis.	{ Fizeau. 49.
" "	.00000137. Normal to "	

Name.	Coëff. of Expansion.	Authority.
Topaz.	.000008325. Lesser horiz.	{ Pfaff. 37. Second paper.
"	.000008362. Greater "	
"	.000004723. Vertical.	
Tourmaline.	.000009369. Longit. axis.	{ Pfaff. 37.
"	.0000077321. Horiz. "	
Garnet.	.000008478. 0°-100°.	Pfaff. 37.
Analtime.	.000009261. "	" " Second paper.
Idocrase.	.0000078721. Longit. axis.	{ Pfaff. 37.
"	.0000096287. Horiz. "	
Zircon.	.000006264. Longit. axis.	{ Pfaff. 37.
"	.0000110540. Horiz. "	
Adularia.	.000015687. } 0°-100°.	{ Pfaff. 37. Second paper.
"	— .000000659. } Three axes at	
"	.000002914. } right angles.	{ Pfaff. 37. Second paper.
Hornblende.	.000008119. } 0°-100°.	
"	.000000843. } Three axes at	{ Pfaff. 37. Second paper.
"	.000009530. } right angles.	
Diopside.	.000008125. } 0°-100°.	{ Pfaff. 37. Second paper.
"	.000016963. } Three axes at	
"	— .000001707. } right angles.	{ Smeaton. W. D. 3. 67.
Glass. Tube.	.0000083333. 0°-100°.	
" "	.0000082800. "	Deluc. "
" "	.0000077615. }	{ Roy. P. T. 1785. 385.
" Rod.	.0000080787. }	
"	.0000086130. 0°-100°.	{ Dulong & Petit. W. D. 3. 69.
"	.0000091827. 100°-200°.	
"	.0000101114. 200°-300°.	
" Tube.	.0000081166. 0°-100°.	{ Lavoisier & Laplace. W. D. 3. 67.
" Plate.	.00000890890. "	
" " Crown.	.0000087572. "	
" " "	.0000089760. "	
" " "	.0000091751. "	{ Kopp. 23.
" White French.	.000008510. 0°-100°.	
" Tube.	.000009230. } Two specimens.	{ Hagen. J. 1856. 48.
" "	.000008766. }	
" Soft Thuringian.	.00001195.	Weinhold. P. A. 149. 186.
Wedgewood ware.	.000008813. 16°-100°.	{ Daniell. 7.
" "	.000008983. 16°-350°.	
Bayeux porcelain.	.0000160. } 1000°-1400°.	{ Deville & Troost. J. 1864. 70.
" "	.0000170. }	
" "	.0000200. Above 1500°.	

VI. ALLOYS.

Name.	Coeff. of Expansion.	Authority.
Platiniridium.		
One tenth Ir.	.00000884. 40.°	Fizeau. 56.
Lead and tin.		
Solder. 2lead. 1 tin.	.0000250800. 0°-100.°	Smeaton. W. D. 3. 68.
Lead and antimony. } Type metal. }	.00002033. 16.°6-100.° .00001952. 16.°6-264.°	Daniell. 7.
Zinc and tin.		
8 zinc. 1 tin.	.0000269200. 0°-100.°	Smeaton. W. D. 3. 68.
Copper and tin.		
8 copper. 1 tin.	.0000181700. 0°-100.	" "
Speculum metal.	.0000193300. "	" "
Bronze. $\frac{1}{4}$ tin.	.00001844. 16.°6-100.°	} Daniell. 7.
" "	.00002116. 16.°6-350.°	
" "	.00001737. 16.°6-957.°	
"	.00001782. 40.°	Fizeau. 56.
Brass.	.000021600. 0°-100.°	Muschenbroek. W. D. 3. 68.
" Cast.	.0000187500. "	} Smeaton. W. D. 3. 68.
" Wire.	.0000193000. "	
"	.0000178300. "	
"	.0000185540. "	} Roy. W. D. 3. 68.
" English.	.0000189280. "	
" "	.0000189490. "	
"	.0000191880. "	Troughton. W. D. 3. 68.
"	.0000186671. "	} Lavoisier & Laplace. W. D. 3. 68.
"	.0000188971. "	
"	.0000188971. "	
" $\frac{1}{4}$ zinc.	.00002143. 16.°6-100.°	} Daniell. 7.
" "	.00002162. 16.°6-350.°	
" "	.00002207. 16.°6-1006.°	
"	.00001859. 40.°	Fizeau. 56.
2 Brass + 1 zinc.	.0000205800. 0°-100.°	Smeaton. W. D. 3. 68.
16 " + 2 tin.	.0000190800. "	" "
Pewter.	.0000228300. "	" "
"	.00002033. 16.°6-100.°	} Daniell. 7.
"	.00001994. 16.°6-206.°	

• VII. MISCELLANEOUS.

Name.	Coëff. of Expansion.	Authority.
Paraffine. Rangoon.	.00027854. 40.°	Fizeau. 56.
Soft coal. Charleroy.	.00002782. 40.°	" "
Ebonite.	.0000770. 16.°7-25.°3.	Kohlrausch. P. M. (4). 47. 156.
"	.0000842. 25.°3-35.°4.	
Deal wood.	Equal to Glass.	Roy. W. D. 3. 67.

A TABLE OF CUBICAL EXPANSIONS,

FOR SOLIDS AND LIQUIDS.

I. ELEMENTARY SUBSTANCES.

Name.	Coëf. of Expansion.	Authority.
Bromine.	.001016027. -7° .	Pierre. 24.
"	.001038186. 0° .	
"	.001318677. $+63$.	
Iodine. Solid.	.000235.	Billet. J. 1855. 46.
" Upon fusion.	.1682.	
" Liquid.	.000856.	
Silver. Compare also with linear table.	.00005831. 0° -100.	Matthiessen. 51.
Thallium. See linear table.		
Sulphur. See linear table.	.000622. 110° -130.	Despretz. 13.
"	.000581. 110° -150.	
"	.000454. 110° -200.	
"	.000428. 110° -250.	Kopp. 31.
" Native cryst.	.000183.	
" Native.	.000137. 0° -13.2.	Kopp. A. C. P. 93. 129.
"	.000223. 13.2 -50.3.	
"	.000259. 50.3 -78.	
"	.000620. 78 -96.5.	
"	.003097. 96.5 -109.9.	
"	.05002. In melting at 115° .	
Selenium. } See linear		
Tellurium. } table.		
Lead. See also linear table.	.000089.	Kopp. 31.
"	.00008399. 0° -100.	Matthiessen. 51.

Name.	Coëff of Expansion.	Authority.
Iron. See also linear table	.0000355. 0°-100°. }	Dulong & Petit. 1.
"	.0000441. 0°-300°. }	Kopp. 31.
"	.000037.	
Cobalt. } See linear table		
Nickel. }		
Copper. See also linear table.	.0000515. 0°-100°. }	Dulong & Petit. 1.
"	.0000565. 0°-300°. }	
"	.000055. 0°-100°. }	Playfair & Joule. 27.
"	.0000767. " }	Kopp. 31.
"	.000051.	Matthiessen. 51.
"	.00004998. 0°-100°.	
Ruthenium. } See linear		
Rhodium. } table.		
Palladium. See also li-	.00003312. 0°-100°.	Matthiessen. 51.
near table.		
Platinum. "	.0000265. 0°-100°. }	Dulong & Petit. 1.
"	.0000275. 0°-300°. }	Matthiessen. 51.
"	.00002658. 0°-100.	
Iridium. } See linear		
Osmium. } table.		
Zinc. See also linear table	.000089.	Kopp. 31.
"	.00008928. 0°-100°.	Matthiessen. 51.
Cadmium. See also li-		
near table.	.0000940.	Kopp. 31.
"	.00009478. 0°-100°.	Matthiessen. 51.
Magnesium. See linear		
table.		
Mercury.		For very early determi-
"		nations see Dalton, Ca-
"		vendish, Deluc, Ach-
"		ard, Roy, Shuckburgh,
"		Cotte, Casbois, Lavo-
"		sier & Laplace, La-
"		lande & Delisle, Ro-
"		senthal, and Lichten-
"		berg.
"	.00017583. 0°-100°. }	Hällström. Gilb. Ann.
"	.00017723. 0°-350°. }	20. 397.
"	.00018018. 0°-100°. }	
"	.00018433. 0°-200°. }	Dulong & Petit. 1.
"	.00018868. 0°-300°. }	
"	.00017405.	Militzer. 28.
"	.00017905. 0°.	
"	.00017950. 10°.	
"	.00018001. 20°.	Regnault. W. D. 3. 56.
"	.00018051. 30°.	See next page.

Name.	Coëff. of Expansion.	Authority.
Mercury.	.00018102. 40°.	See preceding page.
"	.00018152. 50°.	
"	.00018203. 60°.	Regnault. W. D. 3. 56.
"	.00018253. 70°.	
"	.00018304. 80°.	See original paper for fuller series of values.
"	.00018354. 90°.	
"	.00018405. 100°.	
"	.00018657. 150°.	
"	.00018909. 200°.	
"	.00019161. 250°.	
"	.00019413. 300°.	
"	.00019666. 350°.	
"	.0001812. 0°-100°.	Matthiessen. 50.
Indium. See linear table		
Phosphorus.*	.000359. 0°-17°.9.	Erman. 4.
"	.000399. 0°-35°.9.	
"	.001226. 0°-38°.2.	Kopp. A. C. P. 93. 129.
"	.0010024. 0°-61°.2.	
"	.000351. 8°.3-15°.8.	
"	.000371. 15°.8-41°.1.	
"	.000369. 15°.8-43°.1.	
"	.000366. 8°.3-15°.8.	
"	.000396. 15°.8-41°.1.	
"	.000397. 15°.8-43°.1.	
"	.0009371. 0°-70°.	Pisati & DeFranchis. B.D. C. G. 8. 70.
"	.03422. In melting at 44°.	
" Solid.	.000376. 0°-40°.	
" Molten.	.000520. 50°-60°.	
Arsenic. See linear table		
Antimony. See also linear table.	.000033.	Kopp. 31.
"	.00003167. 0°-100°.	Matthiessen. 51.
Bismuth. See also linear table.	.0000400.	Kopp. 31.
"	.00003948. 0°-100°.	Matthiessen. 51.
Gold. See also linear table.	.00004411. "	" "
Diamond. See also linear table.	.00000354. 40°.	Fizeau. 49.
Silicon. See linear table.		
Tin. See also linear table.	.0000690.	Kopp. 31.

* According to Pisati & DeFranchis, if solid Phosphorus at 40° has the volume 1.03446, its volume molten at 44° will be 1.0504. B. D. C. G. 8. 70.

Name.	Coëff. of Expansion.	Authority.
Tin.	.000070.	Kopp. A. C. P. 93. 129.
"	.000065.	Kupffer. A. C. Phys. (2). 40. 285.
"	.00006889. 0°-100°.	Matthiessen. 51.
Aluminum. See linear table.		

II. FLUORIDES, CHLORIDES, BROMIDES AND IODIDES.

Name.	Formula.	Coëff. of Expansion.	Authority.
Calcium fluoride.	Ca F ₂ .	.000062.	Kopp. 81.
" "	"	.000058512. 0°-100°.	Pfaff. 37. Second paper.
Potassium chloride.	K Cl.	.00010944. 0°-100°.	Playfair & Joule. 27.
Ammonium "	NH ₄ Cl.	.000191. "	Playfair & Joule. 27.
Sulphur "	S ₂ Cl ₂ .	.001028. 0°-100°.	Kopp. 35. See details. Second paper.
" "	"	.001118. 0°-150°.	
Calcium "	Ca Cl ₂ . 6 H ₂ O.	.002227. 0°-60°.	Kopp. A. C. P. 93. 129.
" "	"	.09647. In melting at 29°	
Barium "	Ba Cl ₂ .	.00009873. 0°-100°.	Intermediate values given. Playfair & Joule. 27.
Phosphorus trichloride.	P Cl ₃ .	.001128619. 0°.	Pierre. 24. Also 26.
" "	"	.001589242. 78°34'.	
" "	"	.001233. 0°-50°.	Thorpe. B. D. C. G. 8. 331.
" "	"	.001289. 0°-75°9'.	
" oxychloride.	PO Cl ₂ .	.001381. 0°-50°.	Volume given for every 10°.
" "	"	.001230. 0°-100°.	Thorpe. B. D. C. G. 8. 329.
" "	"	.001237. 0°-107°23'.	

Name.	Formula.	Coeff. of Expansion.	Authority.
Phosphorus sulphochloride.	PS Cl ₂ .	.000826. 0°-50°	Thorpe. B. D. C. G. 8. 330. Volume given for every 10°.
" "	"	.0011187. 0°-100°.	
" "	"	.001163. 0°-125°.	
Arsenic trichloride.	As Cl ₃ .	.000925854. -30°	Pierre. 24.
" "	"	.000979073. 0°.	
" "	"	.001333299. 133°81.	
Antimony "	Sb Cl ₃ .	.0008321. 73°2-100°	Kopp. 35. Second paper.
" "	"	.0009675. 73°2-230°	
Carbon dichloride.	C ₂ Cl ₄ .	.001002628. 0°	Pierre. 30.
" "	"	.001299538. 123°9.	
" tetrachloride.	C Cl ₄ .	.001183844. 0°.	
" "	"	.001571522. 78°1.	Pierre. 30.
" "	"	.001162988. 0°-30°.	
" "	"	.001272714. 0°-70°.	
" "	"	.001391845. 0°-110°	Hirn. 52.
" "	"	.00155319. 0°-150°.	
Silicon "	Si Cl ₄ .	.001272135. -40°.	
" "	"	.001294119. 0°.	Pierre. 24.
" "	"	.001978592. 59°.	
Titanium "	Ti Cl ₄ .	.000876944. -25°.	
" "	"	.000942569. 0°.	Pierre. 24.
" "	"	.001357899. 136°.	
Tin "	Sn Cl ₄ .	.001101490. -25°.	
" "	"	.001132801. 0°.	Pierre. 24.
" "	"	.001647378. 115°4.	
Phosphorus tribromide.	P Br ₃ .	.000847205. 0°.	Pierre. 24.
" "	"	.001008780. 100°.	
" "	"	.001149896. 175°3.	
Antimony tribromide.	Sb Br ₃ .	.0008315. 90°-280°.	Kopp. 35. Second paper.
Silicon tetrabromide.	Si Br ₄ .	.000952572. 0°.	Pierre. 24.
" "	"	.001112682. 100°.	
" "	"	.001205180. 153°36.	
Silver iodide.	Ag I.	-.00000718. -18° to 0°	Rodwell. Chem- ical News. 31. 4.
" "	"	-.00003297. 0° to 21°	
" "	"	-.00005570. 21° to 67°	
" "	"	.0000436. 116°-450°	
" "	"	.011323. In changing from amorphous to cryst. at 116°.	
" "	"	.01030001. In fusing at 450°.	

III. OXIDES.

Name.	Formula.	Coëff. of Expansion.	Authority.
Water.*	H ₂ O.	.00045176. 0°-100°.	Deluc. See Gren's J. 1. 216.
"	"	— .0000264. 0°-4°.1.	Hällström. 2. Vol.
"	"	.00013053. 0°-30°.	given for every degree.
"	"	.000231821. 0°-50°.	Muncke. 8. Vol.
"	"	.000429279852.0.-100°.	given for every degree.
"	"	— .0000552.-3 to +3°.75.	Stampfer. 9. Vol.
"	"	.00021553. 3°.75-40°.	given for every degree.
"	"	.0004495. 4°-100°.	Despretz. 14. Vol.
"	"		given for every degree.
"	"	.000213616. -13°.14.	Pierre. 20.
"	"	.000430139. 97°.72.	
"	"	.00042986. 0°-100°.	Kopp. 23. Vols.
"	"		given at intermediate degrees.
"	"	— .000066301. 0°.	Pierre. 26.
"	"	.000440307. 100°.	
"	"	.00042839. 0°-100°.	Hagen. J. 1856. 48.
"	"		Vol. given for every five degrees.
"	"	.00043105. 0°-100°.	Buff. A. C. P. 4th.
"	"		Supp. 129
"	"	.00064713. 0°-157°.	Mendelejeff. A. C.
"	"		P. 119. 1. See paper for many details.
"	"	.000430. 0°-100°.	Sorby. 40. Vol. given at some intermediate temperatures.
"	"	.000598. 0°-150°.	
"	"	.000783. 0°-200°.	

*Details regarding the expansion of water are too full for admission to these tables. Only the leading facts can be here stated. Many interesting series of determinations are unavoidably omitted.

Name.	Formula.	Coeff. of Expansion.	Authority.
Water.	H ₂ O.	— .000034. 0°–4°.	Weidner. 48. Vol. given for every degree.
"	"	— .0001362. —10° to 4°.	
"	"	.0002500. 4°–50°.	Matthiessen. 50. Vol. given for every degree.
"	"	.0004496. 4°–100.	
"	"	.00051655. 4°–120°.	Hirn. 52. Intermediate values given.
"	"	.00079498. 4°–200°.	
"	"	— .00003292. 0°–4°·07.	Rossetti. 53. Every degree given.
"	"	.00025996. 4°·07–50°.	
"	"	.000392. —10° to 100°.	Rossetti. 53. Second paper. Vol. given at every degree.
Ice.	"	.0001585. 0°–1°.	Plücker and Geisler. P. A. 86. 238.
Iodine pentoxide.	I ₂ O ₅ .	.000066. 0°–51°.	Ditte. A.C.Phys. (4). 21. 5.
Sulphur dioxide. L.	S O ₂ .	.001496377. —25°·85.	Pierre. 26.
"	"	.001819947. —8°.	
"	"	.00193. 0°–18°.	Drion. 38. Compare also A. C. Phys. (3). 56. 5.
"	"	.00368. 91°–99°·5.	
"	"	.00463. 108°·5–115°·5.	D'Andréff.
"	"	.00533. 116°–122°.	
"	"	.00600. 122°–127°.	Schultz-Sellack. P. A. 139. 480.
"	"	.00190. —10° to —5°.	
"	"	.00194. —5° to 0°.	Playfair & Joule. 27.
"	"	.00198. 0°–5°.	
"	"	.00202. 5°–10°.	Kopp. 31.
"	"	.00206. 10°–15°.	
"	"	.00210. 15°–20.	Fizeau. 49.
"	"	.00215. 20–25°.	
"	"	.00220. 25°–30°.	Kopp. 31.
"	"	.00225. 30°–35°.	
"	"	.00230. 35°–40°.	Pfaff. 37. Second paper.
Sulphur trioxide.	S O ₃ .	.0027. 25°–45°.	
Lead monoxide.	Pb O.	.0000795. 0°–100°.	Fizeau. 49.
Manganic oxide.	Mn ₂ O ₃ .	.0000522. "	
Ferric "	Fe ₂ O ₃ .	.000040. Hematite.	Kopp. 31.
"	"	.00002501. 40°.	
Ferroso-ferric "	Fe ₃ O ₄ .	.000029. Magnetite.	Pfaff. 37. Second paper.
"	"	.000028620. 0°–100°.	
Copper oxide.	Cu O.	.00000279. 40°.	Fizeau. 49.
Zinc "	Zn O.	.00001394. 40°.	
		Zincite.	"

Name.	Formula.	Coëff. of Expansion.	Authority.
Magnesium oxide.			
Cryst.	Mg O.	.00003129. 40°.	Fizeau. 49.
" "	"	.000003104. 0°-100°.	Calcined at 350°, at 450°, at dark red heat, and at bright red heat.
" "	"	.000002402. "	
" "	"	.000001764. "	
" "	"	.000001634. "	
			Ditte. C. S. J. (2). 9. 869.
Mercuric oxide.	Hg O.	.00005802. 0°-100°.	Playfair & Joule. 27.
Nitrous " L.	N ₂ O.	.00428. -5° to 0°.	D'Andréeff. 39.
" "	"	.00422. 0°-5°.	
" "	"	.00484. 5°-10°.	
" "	"	.00656. 10°-15°.	
" "	"	.00872. 15°-20°.	
Hyponitric acid. L.	N O ₂ .	.001445. 0°.	Coëff. given for every 10° from 0° to 90°.
" "	"	.002021. 50°.	
" "	"	.003081. 90°.	
Arsenic trioxide.			
Cryst.	As ₂ O ₃ .	.00012378. 40°.	Fizeau. 49.
Senarmontite.	Sb ₂ O ₃ .	.00005889. "	" "
Carbon dioxide. L.	C O ₂ .	.0142. 0°-30°.	Thilorier. See 38.
" "	"	.00475. -10° to -5°.	D'Andréeff. 39.
" "	"	.00492. -5° to 0°.	
" "	"	.00540. 0°-5°.	
" "	"	.00629. 5°-10°.	
" "	"	.00769. 10°-15°.	
" "	"	.00975. 15°-20°.	
" "	"	.01277. 20°-25°.	
Quartz.	Si O ₂ .	.000039. }	Kopp. 31.
"	"	.000042. }	Pfaff. 37. Second paper.
"	"	.00003840. 0°-100°.	
"	"	.00003619. 40°.	Fizeau. 49.
Rutile.	Ti O ₂ .	.000032.	Kopp. 31.
"	"	.00002347. 40°.	Fizeau. 49.
Tin dioxide. Powder	Sn O ₂ .	.0000172. 0°-100°.	Playfair & Joule. 27.
Tinstone.	"	.000016.	Kopp. 31.
"	"	.00001389. 0°-100°.	Pfaff. 37. Second paper.
"	"	.00001034. 40°.	Fizeau. 49.
Corundum.	Al ₂ O ₃ .	.00001995. 0°-100°.	Pfaff. 37. Second paper.
"	"	.00001705. 40°.	Fizeau. 49.
Spinel ruby.	Mg O. Al ₂ O ₃ .	.00001787. "	" "
Pleonaste.	—	.00001805. "	" "
Gahnite.	Zn O. Al ₂ O ₃ .	.00001766. "	" "
Kreittomite.	—	.00001750. "	" "

IV. SULPHIDES.

Name.	Formula.	Coeff. of Expansion.	Authority.
Selenium sulphide.	Se S.	.00014176. 0°-52°.	Ditte. A. C. P. 163. 187.
Lead " In powder.	Pb S.	.0001045. 0°-100°.	Playfair & Joule. 27.
Galena.	"	.0000680.	Kopp. 31.
"	"	.000055782. 0°-100°.	Pfaff. 37. Second paper.
Pyrite.	Fe S ₂ .	.000034.	Kopp. 31.
"	"	.000030252. 0°-100°.	Pfaff. 37. Second paper.
Blende.	Zn S.	.0000358.	Kopp. 31.
Carbon disulphide.	C S ₂ .	.0011016. -50° to 0°.	Muncke. 10.
" "	"	.00119625. 0°-40°.	} Vol. given for every degree from -50° to + 70°.
" "	"	.0012517. 0°-70°.	
" "	"	.001072705. -34°.91.	
" "	"	.001332332. 59°.55°.	} Pierre. 20.
" "	"	.001139804. 0°.	
" "	"	.001402735. 47°.9°.	
" "	"	.001236617. 0°-40°.	} Pierre. 26.
" "	"	.001325986. 0°-80°.	
" "	"	.001459566. 0°-120°.	
" "	"	.001660760. 0°-180°.	Hirn. 52.

V. HYDRATES.

Name.	Formula.	Coëff of Expansion.	Authority.
Iodic acid.	H I O_3 .	.0002242. 0° - 58° .8.	Ditte. A. C. Phys. (4). 21. 5.
Sulphuric "	$\text{H}_2 \text{ S O}_4$.	.00031.	Achard. Young's Nat. Phil. 2. 392.
" "	"	.00057849. 0° - 100° .	Every 10° given from -30° to $+230^\circ$. Muncke. 8. Marignac. A. C. Phys. (4). 22. 420.
" "	"	.000596443. 0° - 200° .	
" "	"	.00060373. 0° - 230° .	
" "	"	.0005656. 0° - 23° .	
" "	"	.0005585. 20° .	" C. S. J. (2). 9. 1125.
Nitric "	H N O_3 .	.00114885. 0° - 100° .	Muncke. 8. Every 5° given from -20° to $+115^\circ$.
" "	"	.00117808. 0° - 115° .	

VI. SULPHATES, HYPOSULPHITES AND CHROMATES.

Name.	Formula.	Coëff of Expansion.	Authority.
Potassium sulphate.	$\text{K}_2 \text{ S O}_4$.	.00010697. 0° - 100° .	Playfair & Joule. 27
" bisulphate.	K H S O_4 .	.00012287. "	" "
Ammonium sulphate.	$(\text{N H}_4)_2 \text{ S O}_4$.	.00010934. "	" "
Gypsum. See linear table.	$\text{Ca S O}_4 \cdot 2 \text{ H}_2 \text{ O}$.	.0000750. "	Pfaff. 37. Second paper.
Celestine. See linear table.	Sr S O_4 .	.000061.	Kopp. 31.
"	"	.00005261. 0° - 100° .	Pfaff. 37. Second paper.
Barite. See linear table.	Ba S O_4 .	.000058.	Kopp. 31.
"	"	.00005190. 0° - 100° .	Pfaff. 37. Second paper.

Name.	Formula.	Coëff. of Expansion.	Authority.
Ferrous sulphate.	$\text{Fe S O}_4 \cdot 7 \text{ H}_2 \text{ O}.$	.0001153. $0^\circ\text{--}100^\circ.$	Playfair & Joule. 27
Magnesium sulphate.	$\text{Mg S O}_4 \cdot 7 \text{ H}_2 \text{ O}.$	.0001019. "	" "
Coppersulphate	$\text{Cu S O}_4 \cdot 5 \text{ H}_2 \text{ O}.$	.00005315. "	Three samples. Playfair & Joule. 27
" "	"	.0000812. "	
" "	"	.00009525. "	
Copper ammonium sulphate	$(\text{NH}_4)_2\text{Cu}(\text{S O}_4)_2 \cdot 6 \text{ H}_2 \text{ O}.$	.000066113. $0^\circ\text{--}100^\circ.$	Playfair & Joule. 27
Copper potassium sulphate.	$\text{K}_2 \text{ Cu} (\text{S O}_4)_2 \cdot 6 \text{ H}_2 \text{ O}.$	.00009043. "	" "
Zinc potassium sulphate.	$\text{K}_2 \text{ Zn} (\text{S O}_4)_2 \cdot 6 \text{ H}_2 \text{ O}.$	.00008235. "	" "
Magnesium potassium sulphate.	$\text{K}_2 \text{ Mg} (\text{S O}_4)_2 \cdot 6 \text{ H}_2 \text{ O}.$	.00009372. "	" "
Magnesium ammonium sulphate.	$(\text{NH}_4)_2\text{Mg}(\text{S O}_4)_2 \cdot 6 \text{ H}_2 \text{ O}.$	.00007161. "	" "
Common alum.	$\text{K Al} (\text{S O}_4)_2 \cdot 12 \text{ H}_2 \text{ O}.$	.00003682. $0^\circ\text{--}200^\circ.$	Playfair & Joule. 27
Chrome "	$\text{K Cr} (\text{S O}_4)_2 \cdot 12 \text{ H}_2 \text{ O}.$	.00005242. "	" "
Sodium hyposulphite.	$\text{Na}_2 \text{ S}_2 \text{ O}_3 \cdot 5 \text{ H}_2 \text{ O}.$	.00015111. $0^\circ\text{--}45^\circ.$	Kopp. A. C. P. 93. 129. Vol. given for every 10° , from 0° to 80° .
" "	"	.000925. $0^\circ\text{--}80^\circ.$	
" "	"	.05095. In melting at 45°	
Potassium chromate.	$\text{K}_2 \text{ Cr O}_4.$	.00011005. $0^\circ\text{--}100^\circ.$	Playfair & Joule. 27
" "	"	.0001134. "	
Potassium dichromate.	$\text{K}_2 \text{ Cr}_2 \text{ O}_7.$	.000122. "	Playfair & Joule. 27

VII. CHLORATES, NITRATES AND PHOSPHATES.

Name.	Formula.	Coëff. of Expansion.	Authority.
Potassium chlorate.	$KClO_3$.	.00017112. 0°-100°.	Playfair & Joule. 27.
Sodium nitrate.	$NaNO_3$.	.000128. "	" "
Potassium "	KNO_3 .	.0001967. "	Playfair & Joule. 27.
" " Crystal	"	.00017237. "	
" " Powder	"	.0001947. "	
Barium nitrate.	$BaNO_3$.	.00004523. "	Playfair & Joule. 27.
Lead "	$PbNO_3$.	.0000839. "	" "
Sodium phosphate	$Na_2HPO_4 \cdot 12H_2O$.	.0001371. 0°-35°.	Kopp. A. C. P. 98. 129. Vol. given for every 10° from 0° to 70°.
" "	"	.0010286. 0°-70°.	
" "	"	.05085. In melting at 25°.	
Apatite. See linear table.		.00003123. 0°-100°.	Pfaff. 37. Second paper.

VIII. CARBONATES.

Name.	Formula.	Coëff. of Expansion	Authority.
Calcite. See linear table.	$CaCO_3$.	.0000196. 0°-100°.	Dulong & Mitscherlich. P. A. 1. 127.
"	"	.0000174.	Mitscherlich. P. A. 10. 149.
"	"	.000018.	Kopp. 31.
"	"	.00002010. 0°-100°.	Pfaff. 37. Second paper.
Arragonite. See linear table.	"	.000065.	Kopp. 31.
"	"	.00005802. 0°-100°.	Pfaff. 37. Second paper.
Chalybite. See linear table.	$FeCO_3$.	.000035. (Impure.)	Kopp. 31.
"	"	.00002688.	Pfaff. 37. Second paper.
Dolomite.	$(CaMg)CO_3$.	.000035.	Kopp. 31.

IX. SILICATES.

Name.	Coeff. of Expansion.	Authority.
Emerald. } See linear table	.00000168. 40°.	Fizeau. 49.
Beryl. } " "	.00000105. 0°-100°.	Pfaff. 37. Second paper.
Topaz. " "	.00002137. "	" " "
Tourmaline. " "	.00002181. "	" " "
Garnet. " "	.000025434. "	" " "
Analcime. " "	.000027783. "	" " "
Idocrase. " "	.00002700. "	" " "
Zircon. " "	.00002835. "	" " "
Orthoclase } .000026. }		{ Kopp. 31.
" " } .000017. }		
Adularia. } See linear table	.00001794. 0°-100°.	Pfaff. 37. Second paper.
Hornblende. " "	.00002845. "	" " "
Diopside. " "	.00002330. "	" " "
Glass. See linear table.	.0000258. 0°-100°.	Dulong & Petit. 1.
" "	.0000275. 0°-200°.	
" "	.0000304. 0°-300°.	Muncke. 8.
" "	.0000265445. 0°-1°.	
" White. Tube.	.00002648. 0°-100°.	Regnault. 16.
" " Globule. }	.00002592. }	
" " " }	.00002514. }	
" Green. Tube.	.00002299. "	
" " Globule.	.00002132. "	
" Swedish. Tube.	.00002363. "	
" " Globule. }	.00002441. }	
" " " }	.00002411. }	
" Hard French. Tube.	.00002142. "	
" " " Globule	.00002242. "	
" Crystal. Tube.	.00002101. "	Regnault. W. D. 3. 71.
" " Globule.	.00002330. "	
" Globe. }	.00002304. }	
" " }	.00002349. }	
" Common tube.	.00002579. m. of 12. 0°-1°.	
" Common.	.0000276. 0°-100°.	
" " "	.0000305. 0°-300°.	
" { Crystal Glass from	.0000228. 0°-100°.	
" Choisy le Roi.	.0000233. 0°-300°.	Kopp. 23.
" White French.	.000025531. 0°-100°.	
" Soft soda glass.	.000026. }	
" " " "	.000024. }	
" Hard potash glass.	.000021. }	Kopp. 31.

Name.	Coëff. of Expansion.	Authority.
Glass.	.0000277. 0°-100°.	Mendelejeff. A.C.P. 119.1.
" From St. Gobain.	.00002331. 40°.	Fizeau. 49.
"	.00002566. 0°-100°.	Matthiessen. 50.
" Soft Thuringian.	.0000305.	Weinhold. P. A. 149. 186.
" "	.0000359.	
Bayeux Porcelain.	.0000108. 0°-860°.	Deville & Troost. W. D.
" "	.0000108. 0°-100°.	

X. MISCELLANEOUS INORGANIC BODIES.

Name.	Coëff. of Expansion.	Authority.
Ammonia. NH_3 .	.00146. 10°.	Jolly. A. C. P. 170. 190.
"	.00166. 10°.4.	
"	.00152. 11°.	
"	.00190. -10° to -5°.	D'Andréff. 89.
"	.00200. -5° to 0°.	
"	.00210. 0°-5°.	
"	.00220. 5°-10°.	
"	.00230. 10°-15°.	
"	.00240. 15°-20°.	
Aqua ammonia.	.00044069. 0°-45°.	{ Muncke. 8. Vol. given at every degree from -15° to +45°.
Aqueous hydrochloric acid.	.00056355. 0°-45°.	{ Muncke. 8. Vol. given for every 5° from -20° to +45°.
Cyanic acid. L.	.0003300. -20° to -14°.	Troost & Hautefeuille. J. 21. 314.
" "	.0006999. -20° to 0°.	
" "	.0008450. -3° to 0°.	
Chloronitric acid.	.0020091. 0°-6°.	Baudrimont. J. F. P. 31. 478.
" "	.0035648. 6°.4-18°.4.	

XI. ALLOYS.

Name.	Coëff. of Expansion.	Authority.
Lead and tin.		
Pb Sn ₄ .	.00007188. 0°-100°.	Matthiessen. 51.
Pb ₄ Sn.	.00008419. "	" "
Lead and cadmium.		
Pb Cd.	.00009138. 0°.-100°.	Matthiessen. 51.
Lead and bismuth.		
Pb ₂ Bi.	.00008621. 0°.-100°.	Matthiessen. 51.
Pb Bi ₃₄ .	.00004086. "	" "
Lead and mercury.		
1 vol. Pb with 2 vols. Hg	.00012515.	Kupffer. A. C. Phys. (2). 40. 285.
1 " 3 "	.00012884.	" "
1 " 4 "	.00013291.	" "
Silver and copper.		
86.1 per cent. silver.	.00005436. 0°-100°.	Matthiessen. 51.
71.6 " "	.00005713. "	" "
Silver and platinum.		
66.6 per cent. silver.	.00004568. 0°-100°.	Matthiessen. 51.
Silver and gold.		
Ag ₄ Au.	.00005166. 0°-100°.	Matthiessen. 51.
Ag Au.	.00004916. "	" "
Ag Au ₄ .	.00004300. "	" "
Copper and gold.		
66.6 per cent. gold.	.00004657. 0°-100°.	Matthiessen. 51.
Copper and zinc.		
Brass. 71 per cent. Cu.	.00005719. 0°-100°.	Matthiessen. 51.
Zinc and tin.		
Zn Sn ₄ .	.00007184. 0°-100°.	Matthiessen. 51.
Zn Sn ₆ .	.00007058. "	" "
Tin and bismuth.		
Sn ₂ Bi.	.00005098. 0°-100°.	Matthiessen. 51.
Sn Bi ₄₄ .	.00004064. "	" "
Tin and gold.		
Sn ₂ Au.	.00004233. 0°-100°.	Matthiessen. 51.
Sn ₇ Au ₂ .	.00004428. "	" "
Tin and mercury.		
Sn ₃ Hg.	.0000998.	Kupffer. A. C. Phys. (2). 40. 285.
Sn ₂ Hg.	.000103.	" "
Sn Hg.	.000122.	" "
Sn Hg ₂ .	.0001313.	" "

Name.	Coëff. of Expansion.	Authority.
1 vol. Sn to 1 vol. Hg.	.000119576.	Kupffer. A. C. Phys. (2). 40. 285.
1 " 2 "	.00014055.	" "
1 " 3 "	.0001245.	" "
Lead, tin, and bismuth.	.00002304. 0°-56°.	Erman. 4.
{ 2 parts Bi, 1 part	— .00008387. 0°-62°.	
{ Pb, 1 part Sn.	— .00010304. 0°-69°.	
"	— .00008146. 0°-75°.	
"	.0000005747. 0°-87°.	
"	.0001792. 0°-100°.	
"	.00017475. 0°-200°.	
"	.00003143. 0°-70°.	Kopp. A. C. P. 93. 129. Volume given for every 10° from 0° to 110°.
"	— .00005611. 0°-95°.	
"	.0001104. 0°-100°.	
"	.0001411. 0°-110°.	

XII. HYDROCARBONS.

Name.	Formula.	Coëff. of Expansion.	Authority.
Butyl.	(C ₄ H ₉) ₂ .	.001404. 0°-100°.	Kopp. 35. Second paper. Values given for intermediate t°s.
"	"	.001441. 0°-110°.	
Benzol.	C ₆ H ₆ .	.001213. 0°-25°.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 85°.
"	"	.001260. 0°-50°.	
"	"	.001317. 0°-75°.	
"	"	.001343. 0°-85°.	
"	"	.001205. 0°-20°.	
"	"	.001250. 0°-40°.	Louguinine. 54. Vol. given for every 5° from 0° to 80°.
"	"	.001293. 0°-60°.	
"	"	.0013375. 0°-80°.	{ Pisati & Paterno. C. S. J. (2). 12. 686. Volume also given at 15°, 25°, and 50°.
"	"	.00131. 0°-75°.	
Toluol	C ₇ H ₈ .	.001060. 0°-20°.	Louguinine. 54. Vol. given for every 10° from 0° to 100°.
"	"	.0010975. 0°-40°.	
"	"	.0011333. 0°-60°.	
"	"	.001171. 0°-80°.	
"	"	.001206. 0°-100°.	Louguinine. 54. Vol. given for every 10° from 0° to 100°.
Xylol.	C ₈ H ₁₀ .	.000985. 0°-20°.	
"	"	.001016. 0°-40°.	
"	"	.001048. 0°-60°.	
"	"	.001081. 0°-80°.	
"	"	.001113. 0°-100°.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Cumol.	$C_9 H_{12}$.0010907. $0^\circ-100^\circ$.	Pisati & Paterno. C. S. J. (2). 12. 686. Volume given at $25^\circ, 50^\circ$, and 75° .
Cymol.	$C_{10} H_{14}$.001028. $0^\circ-100^\circ$.	Kopp. 35. Volume given at intermediate temperatures.
"	"	.0011661. $0^\circ-180^\circ$.	
"	"	.000954. $0^\circ-50^\circ$.	Pisati & Paterno. C. S. J. (2). 12. 686. Values given for every 5° .
"	"	.00102389. $0^\circ-100^\circ$.	
" From cummin oil.	"	.000920. $0^\circ-20^\circ$.	Louguinine. 54. Vol. given for every 10° from 0° to 100° .
" " " "	"	.000946. $0^\circ-40^\circ$.	
" " " "	"	.0009725. $0^\circ-60^\circ$.	
" " " "	"	.0009855. $0^\circ-80^\circ$.	
" " " "	"	.0010229. $0^\circ-100^\circ$.	
" " camphor.	"	.0009512. $0^\circ-40^\circ$.	Louguinine. 54. Vol. given for every 10° from 0° to 100° .
" " "	"	.0010581. $0^\circ-100^\circ$.	
Naphthaline. L.	$C_{10} H_8$.0007836. $79^\circ.2-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
"	"	.0010021. $79^\circ.2-220^\circ$.	
Terebene.	$C_{10} H_{16}$.000896554. 0° .	Pierre. 26 and 30.
"	"	.001327673. 161° .	
Oil of turpentine.	"	.0010346. $0^\circ-150^\circ$.	Frankenheim. J. 1. 68.
" "	"	—.00088. -10° to 0° .	Kopp. A. C. P. 93. 129. Vol. given for every 5° from -10° to $+110^\circ$.
" "	"	.001051. $0^\circ-100^\circ$.	
" "	"	.001062. $0^\circ-110^\circ$.	
" "	"	.00085019. $0^\circ-40^\circ$.	Hirn. 52.
" "	"	.00095838. $0^\circ-80^\circ$.	
" "	"	.00103773. $0^\circ-120^\circ$.	
" "	"	.00111478. $0^\circ-160^\circ$.	
" "	"	.00066, to .00068.	Gladstone. C. S. J. (2). 10. 1.
" citron.	"	.0010227. $0^\circ-135^\circ$.	Frankenheim. J. 1. 68. Two samples.
" "	"	.0010368. $0^\circ-120^\circ$.	
" rosewood.	$C_{15} H_{24}$.000642, to .00065.	Gladstone. C. S. J. (2). 10. 1.

Name.	Formula.	Coeff. of Expansion.	Authority.
Rectified petroleum.	—	.00111576. 0°-95°.	Muncke. 8. Volume given for every 5° from 0° to 95°. Frankenheim. P. A. 72. 422. Vol. given for every 5°.
Petroleum.	—	.001039. 0°-100°.	
"	—	.0010669. 0°-120°.	

XIII. COMPOUNDS CONSISTING OF C, H, AND O.

Name.	Formula.	Coeff. of Expansion.	Authority.
Methyl alcohol.	C H ₄ O.	.001131647. -37°.99.	Pierre. 20.
" "	"	.001348109. 69°.38.	
" "	"	.001109738. -35°.	Pierre. 21 and 26.
" "	"	.001185570. 0°.	
" "	"	.001491250. 63°.	
" "	"	.0012534. 0°-65°.	{ Kopp. 23. Values given for intermediate temperatures.
" "	"	.0012483. 0°-60°.	
" "	"	.00129. 10°-20°.	Dupré. P. A. 148. 236.
Ethyl alcohol.	C ₂ H ₅ O.	.0007184. -50° to 0°.	Muncke. 8. Vol. given for every degree from -50° to +70°.
" "	"	.0010879. 0°-50°.	
" "	"	.0011328. 0°-70°.	Muncke. 10. Every degree given from -100° to +70°.
" "	"	.0005418. -100° to 0°.	
" "	"	.0011383. 0°-70°.	Guy Lussac. 1816. } See P. " " 1822. } A. 140 137.
" "	"	.0010503. 0°-30°.	
" "	"	.0010313. 0°-30°.	Pierre. 20.
" "	"	.000994456. -32°.22.	
" "	"	.001194785. 76°.73.	Pierre. 21 and 26.
" "	"	.000944782. -30°.	
" "	"	.001048630. 0°.	Pierre. 21 and 26.
" "	"	.001347576. 78°. 3.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Ethyl alcohol.	$C_2 H_6 O.$	.0011246. $0^\circ-50^\circ.$	Kopp. 23. Vol. given for every 5° from 0° to $80^\circ.$
" "	"	.0012169. $0^\circ-80^\circ.$	
" "	"	.0012957. $0^\circ-99^\circ.87.$	Mendelejeff. A. C. P. 119. 1.
" "	"	.0014477. $0^\circ-130^\circ.9.$	
" "	"	.0010700. $0^\circ-30^\circ.$	V. Baumhauer & v. Moorsel. P. A. 140. 361. Vol. given for every $5^\circ.$
" "	"	.001085855. $0^\circ-50^\circ.$	
" "	"	.0012734849. $0^\circ-100^\circ.$	Hirn. 52.
" "	"	.00160491. $0^\circ-150^\circ.$	
" "	"	.0023832443. $0^\circ-200^\circ.$	
Propyl "	$C_3 H_8 O.$	.0010600. $0^\circ-50^\circ.$	Pierre & Puchot. A. C. Phys. (4). 22. 234.
" "	"	.0011633. $0^\circ-98^\circ.$	
Butyl "	$C_4 H_{10} O.$	.001160. $0^\circ-100^\circ.$	Pierre & Puchot. A. C. P. 163. 268. Vol. given for every $10^\circ.$
" "	"	.001189. $0^\circ-108^\circ.$	
Amyl "	$C_5 H_{12} O.$	.000878287. $-15^\circ.$	Pierre. 21 and 26.
" "	"	.000890011. $0^\circ.$	
" "	"	.001339328. $100^\circ.$	Kopp. 23. Second paper. Vol. given for every 5° from 0° to $135^\circ.$
" "	"	.001606382. $131^\circ.8.$	
" "	"	.0009594. $0^\circ-50^\circ.$	Kopp. 35. Values given for intermediate temperatures.
" "	"	.0010808. $0^\circ-100^\circ.$	
" "	"	.0012066. $0^\circ-135^\circ.$	
" "	"	.001088. $0^\circ-100^\circ.$	Erlenmeyer & Hell. A. C. P. 160. 257. Values given for volume at intermediate temperatures.
" "	"	.001277. $0^\circ-140^\circ.$	
" "	"	.0008745. $0^\circ-50^\circ.$	Erlenmeyer & Hell. A. C. P. 160. 257. Values given for volume at intermediate temperatures.
" "	"	.0010642. $0^\circ-100^\circ.$	
" "	"	.001188. $0^\circ-120^\circ.$	
" "	"	.0009514. $0^\circ-50^\circ.$	Erlenmeyer & Hell. A. C. P. 160. 257. Values given for volume at intermediate temperatures.
" "	"	.0010739. $0^\circ-100^\circ.$	
" "	"	.0011323. $0^\circ-120^\circ.$	
Amylene hydrate.	$C_6 H_{12} O.$	.00085. $0^\circ-18^\circ.$	Wagner & Saytzeff. A. C. P. 179. 320.
Trimethyl carbinol.	$C_4 H_{10} O.$	.00136. $30^\circ-50^\circ.$	Butlerow. A. C. P. 162. 228.
Hydrate of trimethyl carbinol.	$(C_4 H_{10} O)_2 H_2 O$	.00108. $0^\circ-30^\circ.$	" "

Name.	Formula.	Coëff. of Expansion.	Authority.
Diethyl carbinol.	$C_5 H_{12} O$.	.00102. $0^\circ-18^\circ$.	Wagner & Saytzeff. A. C. P. 179. 320.
Dimethyl pseudopropyl carbinol.	$C_6 H_{14} O$.	.00099. $0^\circ-50^\circ$.	Prianichnickow. A. C. P. 162. 69.
Ethyl oxide.	$C_4 H_{10} O$.	.001441. -21° to 0° .	Muncke. 8. Vol. given for every 5° from -21° to $+40^\circ$
" "	"	.0015881. $0^\circ-40^\circ$.	
" "	"	.001470095. $-15^\circ.36$.	Pierre. 20.
" "	"	.001629718. $38^\circ.14^\circ$.	
" "	"	.001518. $0^\circ-10^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 35° .
" "	"	.001561. $0^\circ-20^\circ$.	
" "	"	.001636. $0^\circ-35^\circ$.	
" "	"	.001513245. 0° .	Pierre. 26.
" "	"	.001832171. $35^\circ.5$.	
" "	"	.002095. $0^\circ-99^\circ.82$.	Mendelejeff. A. C. P. 119. 1. Other values given.
" "	"	.002697. $0^\circ-157^\circ$.	
Formic acid.	$C H_2 O_2$.	.0010120. $0^\circ-25^\circ$.	Kopp. 23. Second paper. Volume given for every 5° from 0° to 105° .
" "	"	.0010388. $0^\circ-50^\circ$.	
" "	"	.0010731. $0^\circ 75^\circ$.	
" "	"	.0011241. $0^\circ-105^\circ$.	
Acetic "	$C_2 H_4 O_2$.	.0010902. $0^\circ-50^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 120° .
" "	"	.0011717. $0^\circ-100^\circ$.	
" "	"	.0012178. $0^\circ-120^\circ$.	
Propionic acid.	$C_3 H_6 O_2$.	.001192. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Vol. given for intermediate temperatures.
" "	"	.001290. $0^\circ-150^\circ$.	
Butyric acid.	$C_4 H_8 O_2$.	.0010878. $0^\circ-50^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 160° .
" "	"	.0011565. $0^\circ-100^\circ$.	
" "	"	.0012749. $0^\circ-160^\circ$.	
" "	"	.001025720. 0° .	Pierre. 26.
" "	"	.001598958. 163° .	
" "	"	.001144695. 100° .	Pierre. 29.
Isobutyric "	"	.001092. $0^\circ-50^\circ$.	Morkownikoff. A. C. P. 138. 368.
" "	"	.001166. $0^\circ-100^\circ$.	
Valeric "	$C_5 H_{10} O_2$.	.0011060. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Interme- diate values given
" "	"	.0012717. $0^\circ-180^\circ$.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Valeric acid. } From isobutyryl cyanide.	$C_5 H_{10} O_2$.0010056. $0^\circ-50^\circ$.	Erlenmeyer & Hell. A. C. P. 160. 257. Volumes given for every 10° .
" " } " "	"	.0010794. $0^\circ-100^\circ$.	
" " } " "	"	.0011132. $0^\circ-120^\circ$.	
" " } From valerian.	"	.0010008. $0^\circ-50^\circ$.	
" " } " "	"	.0010775. $0^\circ-100^\circ$.	
" " } " "	"	.0011098. $0^\circ-120^\circ$.	
" " } From fusel oil.	"	.00100548. $0^\circ-50^\circ$.	Butlerow. B. D. C. G. 7. 728.
" " } " "	"	.0010816. $0^\circ-100^\circ$.	
" " } " "	"	.0011157. $0^\circ-120^\circ$.	
Trimethylacetic acid.	"	.00112. $50^\circ-75^\circ$.	
" " "	"	.00120. $75^\circ-100^\circ$.	
Stearic acid.	$C_{18} H_{36} O_2$.00052. $9^\circ 2'-33^\circ 8'$.	Kopp. A. C. P. 93. 129.
" " "	"	.00066. $33^\circ 8'-45^\circ 5'$.	
" " "	"	.00115. $45^\circ 5'-61^\circ 2'$.	
" " "	"	.00475. $61^\circ 2'-66^\circ 5'$.	
" " "	"	.00060. $9^\circ 2'-33^\circ 8'$.	
" " "	"	.00081. $33^\circ 8'-45^\circ 5'$.	
" " "	"	.00117. $45^\circ 5'-61^\circ 2'$.	
" " "	"	.00347. $61^\circ 2'-66^\circ 5'$.	
" " "	"	.10988. { Expansion in moment of fusion at 70° .	
Acetic anhydride.	$C_4 H_6 O_3$.0012450. $0^\circ-100^\circ$.	Kopp. 35. Values given at intermediate temperatures.
" " "	"	.0013257. $0^\circ-140^\circ$.	
Methyl formate.	$C_2 H_4 O_2$.0014413. $0^\circ-15^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° .
" " "	"	.0015514. $0^\circ-35^\circ$.	
Ethyl " "	$C_3 H_6 O_2$.001236497. $-32^\circ 43'$.	Pierre. 20.
" " "	"	.001522943. $61^\circ 54'$.	
" " "	"	.0013924. $0^\circ-25^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° .
" " "	"	.0014891. $0^\circ-55^\circ$.	
" " "	"	.001325205. 0° .	Pierre. 26.
" " "	"	.001679323. $52^\circ 9'$.	
Propyl " "	$C_4 H_8 O_2$.001306. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Intermediate values also given.
" " "	"	.0014123. $0^\circ-82^\circ 7'$.	
Butyl " "	$C_5 H_{10} O_2$.001240. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Intermediate values given.
" " "	"	.0013655. $0^\circ-98^\circ 5'$.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Methyl acetate.	$C_2 H_4 O_2$.001219574. $-34^{\circ}.30$.	Pierre. 20.
"	"	.001509544. $66^{\circ}.26$.	
"	"	.001132859. -30° .	
"	"	.001295954. 0° .	Pierre. 21 & 26.
"	"	.001687434. $59^{\circ}.5$.	
"	"	.001374. $0^{\circ}-25^{\circ}$.	Kopp. 23. Second paper. Vol. given for every 5° .
"	"	.0014838. $0^{\circ}-55^{\circ}$.	
Ethyl	$C_4 H_8 O_2$.001029108. -40° .	Pierre. 21 & 26.
"	"	.001258496. 0° .	
"	"	.001719623. $74^{\circ}.14$.	
"	"	.0013360. $0^{\circ}-25^{\circ}$.	Kopp. 23. Second paper. Vol. given for every 5° , from 0° to 75° .
"	"	.0014128. $0^{\circ}-50^{\circ}$.	
"	"	.0015045. $0^{\circ}-75^{\circ}$.	Frankenheim. P. A. 72. 422.
"	"	.0012941. $0^{\circ}-70^{\circ}$.	
Propyl	$C_3 H_8 O_2$.0013000. $0^{\circ}-50^{\circ}$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
"	"	.0014610. $0^{\circ}-100^{\circ}$.	
"	"	.0014709. $0^{\circ}-103^{\circ}$.	
Butyl	$C_4 H_{12} O_2$.001432. $0^{\circ}-50^{\circ}$.	Chapman & Smith. C. S. J. 22. 160.
"	"	.0012280. $0^{\circ}-50^{\circ}$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Val- ues given for interme- diate temperatures.
"	"	.0011350. $0^{\circ}-100^{\circ}$.	
"	"	.0014017. $0^{\circ}-116^{\circ}.5$.	
Amyl	$C_5 H_{14} O_2$.001271. $0^{\circ}-100^{\circ}$.	Kopp. 35. Intermediate values given.
"	"	.0013921. $0^{\circ}-140^{\circ}$.	
Hexyl	$C_6 H_{16} O_2$.001126. $0^{\circ}-50^{\circ}$.	Wanklyn & Erlenmeyer. J. 16. 522.
Ethylpropionate	$C_5 H_{10} O_2$.001510. $0^{\circ}-100^{\circ}$.	Kopp. 35. Second pa- per. Intermediate val- ues given.
"	"	"	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
"	"	.001330. $0^{\circ}-50^{\circ}$.	
"	"	.001505. $0^{\circ}-100^{\circ}$.	
Propyl	$C_4 H_{12} O_2$.001180. $0^{\circ}-50^{\circ}$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
"	"	.001340. $0^{\circ}-100^{\circ}$.	
"	"	.001451. $0^{\circ}-124^{\circ}.75$.	
Butyl	$C_4 H_{14} O_2$.001186. $0^{\circ}-50^{\circ}$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
"	"	.001302. $0^{\circ}-100^{\circ}$.	
"	"	.0014835. $0^{\circ}-135^{\circ}.7$.	
Methyl butyrate.	$C_5 H_{10} O_2$.001239896. 0° .	Pierre. 21 & 26.
"	"	.001776201. $102^{\circ}.1$.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Methyl butyrate.	$C_6 H_{10} O_2$.0013108. $0^\circ-50^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° .
" "	"	.0014750. $0^\circ-100^\circ$.	
Ethyl "	$C_6 H_{12} O_2$.001202792. 0° .	Pierre. 21 & 26.
" "	"	.001534408. 119° .	
" "	"	.0012457. $0^\circ-40^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° .
" "	"	.0013441. $0^\circ-80^\circ$.	
" "	"	.0014552. $0^\circ-115^\circ$.	
Propyl "	$C_7 H_{14} O_2$.001210. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
" "	"	.001315. $0^\circ-100^\circ$.	
" "	"	.0014237. $0^\circ-135^\circ$.	
Butyl "	$C_8 H_{16} O_2$.001100. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
" "	"	.001240. $0^\circ-100^\circ$.	
" "	"	.0014007. $0^\circ-149^\circ.5$	
Amyl "	$C_9 H_{18} O_2$.001100. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
" "	"	.001190. $0^\circ-100^\circ$.	
" "	"	.0013594. $0^\circ-170^\circ.3$.	
Methyl valerate.	$C_8 H_{14} O_2$.001221. $0^\circ-50^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 120° .
" "	"	.0013503. $0^\circ-100^\circ$.	
" "	"	.001410. $0^\circ-120^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
" "	"	.001208. $0^\circ-50^\circ$.	
" "	"	.001334. $0^\circ-100^\circ$.	
" "	"	.0013872. $0^\circ-117^\circ.5$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
Ethyl "	$C_7 H_{14} O_2$	.001166. $0^\circ-50^\circ$.
" "	"	.001295. $0^\circ-100^\circ$.	
" "	"	.0014022. $0^\circ 135^\circ.5$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
Propyl "	$C_8 H_{16} O_2$	.001100. $0^\circ-50^\circ$.
" "	"	.001206. $0^\circ-100^\circ$.	
" "	"	.0014178. $0^\circ-157^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
Butyl "	$C_9 H_{18} O_2$	.001064. $0^\circ-50^\circ$.
" "	"	.001153. $0^\circ-100^\circ$.	
" "	"	.0012953. $0^\circ-173^\circ.4$.	Kopp. 35. Volume given at intermediate tem- peratures.
Amyl "	$C_{10} H_{20} O_2$	.001117. $0^\circ-100^\circ$.
" "	"	.0013247. $0^\circ-190^\circ$.	
" "	"	.000980. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
" "	"	.0011000. $0^\circ-100^\circ$.	
" "	"	.0013079. $0^\circ-190^\circ$.	
Butyl glycol	$C_4 H_{10} O_2$.00073. $0^\circ-17^\circ.5$.	Grabowsky & Saytzeff. A. C. P. 179. 333.
Amyl "	$C_5 H_{12} O_2$.00077. $0^\circ-19^\circ$.	Wagner & Saytzeff. A. C. P. 179. 309.

Name.	Formula.	Coeff. of Expansion.	Authority.
Amyl glycol.	$C_5 H_{12} O_2$.	.00076. $0^\circ-21^\circ$.	Flavitzky. A.C.P. 179. 353
Acetic aldehyde.	$C_2 H_4 O$.	.001616. $0^\circ-10^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° .
" "	"	.001686. $0^\circ-20^\circ$.	
" "	"	.001653523. 0° .	
" "	"	.001121090. 22° .	Pierre. 26.
Propionic "	$C_3 H_6 O$.	.001600. $0^\circ-20^\circ$.	
" "	"	.001650. $0^\circ-40^\circ$.	Pierre & Puchot. A. C. P. 155. 362.
" "	"	.001674. $0^\circ-46^\circ$.	
Butyric aldehyde	$C_4 H_8 O$.	.001350. $0^\circ-20^\circ$.	Pierre & Puchot. A. C. P. 155. 362.
" "	"	.001462. $0^\circ-40^\circ$.	
" "	"	.001606. $0^\circ-62^\circ$.	
Valeric "	$C_5 H_{10} O$.	.001452. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.0012625. $0^\circ-40^\circ$.	Pierre & Puchot. A. C. P. 155. 362. Intermediate values given
" "	"	.0014454. $0^\circ-92^\circ$.	
Hexyl " β	$C_6 H_{12} O$.	.001152. $0^\circ-50^\circ$.	Wanklyn & Erlenmeyer. J. 16. 522.
Acetone.	$C_3 H_8 O$.	.001405. $0^\circ-20^\circ$.	Kopp. 23. Second paper. Vol. given for every 5° from 0° to 60° .
"	"	.001471. $0^\circ-40^\circ$.	
"	"	.0015463. $0^\circ-60^\circ$.	
Diethyl ketone.	$C_5 H_{10} O$.	.00116.	{ Wagner & Saytzeff. A. C. P. 179. 323.
Ketone from amylen.	"	.00119.	
Oxalic acid.	$C_2 H_2 O_4 2H_2 O$.	.00027476. $0^\circ-100^\circ$.	Playfair & Joule. 27.
Methyl oxalate.	$C_4 H_4 O_6$.	.0011560. $50^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
" "	"	.0012683. $50^\circ-170^\circ$.	
Ethyl "	$C_6 H_{10} O_4$.	.001200. $0^\circ-100^\circ$.	Kopp 35. Intermediate values given.
" "	"	.0013994. $0^\circ-190^\circ$.	
" succinate.	$C_8 H_{14} O_4$.	.001094. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
" "	"	.0013323. $0^\circ-220^\circ$.	
Pinacolin. Synthetic.	$C_6 H_{12} O$.	.00122. $0^\circ-50^\circ$.	Butlerow. A. C. P. 174. 127.
" From acetone.	"	.00117. $0^\circ-50^\circ$.	
Methyl amyl pinacolin.	$C_7 H_{14} O$.	.00102. $0^\circ-21^\circ$.	Wichnegradsky. B. D. C. G. 8. 541.
Butyl ethyl pinacolin.	"	.00109. $0^\circ-21^\circ$.	
Ethyl amyl pinacolin.	$C_8 H_{16} O$.	.00098. $0^\circ-21^\circ$.	

Name.	Formula.	Coëff. of Expansion.	Authority.
Ethyl carbonate.	$C_5 H_{10} O_3$	.001322. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
" "	"	.0014054. $0^\circ-130^\circ$.	
" cinnamate.	$C_{11} H_{12} O_2$	.000889. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
" "	"	.0010893. $0^\circ-270^\circ$.	
Methyl benzoate.	$C_8 H_8 O_2$	.001005. $0^\circ-100^\circ$.	Kopp. 35. Vol. given at intermediate temperatures.
" "	"	.001168. $0^\circ-200^\circ$.	
Ethyl "	$C_9 H_{10} O_2$	.000975. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.001376. $0^\circ-210^\circ$.	
Amyl "	$C_{12} H_{16} O_2$	.000910. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.0011193. $0^\circ-270^\circ$.	
Methyl homotoluylate.	$C_{10} H_{12} O_2$	.0009286. $0^\circ-49^\circ$.	Erlenmeyer. J. 19. 366.
Ethyl "	$C_{11} H_{14} O_2$	.0008592. $0^\circ-49^\circ$.	" J. 19. 367.
Amyl "	$C_{14} H_{20} O_2$	.0006133. $0^\circ-49^\circ$.	" "
Diethyl oxybenzoate.	$C_{11} H_{14} O_3$	.000735.	Heintz. A. C. P. 153. 332.
Methylsalicylate	$C_9 H_8 O_3$	.000909. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.0010704. $0^\circ-230^\circ$.	
Benzoic acid. L.	$C_7 H_6 O_2$	.0009634. $121^\circ.4-250^\circ$.	Kopp. 35.
Alpha toluic acid	$C_8 H_8 O_2$	.000825. $83^\circ-135^\circ$.	Möller & Strecker. J. 12. 299.
Benzoyl hydride.	$C_7 H_6 O$	.000939. $9^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.0010535. $0^\circ-180^\circ$.	
Benzyl alcohol.	$C_7 H_8 O$	.000866. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
" "	"	.0010148. $0^\circ-210^\circ$.	
Phenol.	$C_6 H_6 O$	.000841. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
"	"	.000983. $0^\circ-200^\circ$.	
Xylenol. L.	$C_8 H_{10} O$	.000868. $0^\circ-81^\circ$.	Wurtz. A. C. Phys. (4) 25. 118.
Cuminol.	$C_{10} H_{12} O$	.000898. $0^\circ-100^\circ$.	Kopp. 35. Intermediate values given.
"	"	.0010958. $0^\circ-240^\circ$.	
Triethyl ether of propy phycite.	$C_9 H_{20} O_4$	.001129. $0^\circ-84^\circ$.	Wolff. B. S. C. 13. 150.
Cane Sugar.	$C_{12} H_{22} O_{11}$	.0001116. $0^\circ-100^\circ$.	Playfair & Joule. 27.
Lactose.	$C_{12} H_{22} O_{11}$	.00009111. "	" " "
Stearine.	$C_{57} H_{110} O_6$	.0008433. $0^\circ-90^\circ$.	Kopp. A. C. P. 93. 129.
"	"	.04963. In melting at 60° .	

Name.	Formula.	Coëff. of Expansion.	Authority.
Beeswax.		.000637. 10°-25°.7. }	Kopp. A. C. P. 98. 129. Two series of determinations.
"		.001098. 25°.7-30°.8 }	
"		.001439. 30°.8-43°.1 }	
"		.004558. 43°.1-47°.1 }	
"		.000743. 10°-25°.7. }	
"		.000772. 25°.7-30°.8 }	
"		.001478. 30°.8-43°.1 }	
"		.004578. 43°.1-47°.1 }	
		.00422. In melting at 64°.	
Olive Oil!		.000803. 0°-100°. }	Kopp. A. C. P. 98. 129. Vol. given for every 5°.
" "		.0008242. 0°-120°. }	
" "		.000629.	
Almond Oil.		.000787. 0°-100°. }	Muncke. 8. Vol. given for every 5°
" "		.000794. 0°-120°. }	

XIV. COMPOUNDS CONSISTING OF C, H, N; OR C, H, N, O.

Name.	Formula.	Coëff. of Expansion.	Authority.
Methyl cyanide.	$C_2H_5, C N.$	.00145125. 0°-80°.	Kopp. 35. Third paper. Intermediate values given.
Isobutyl "	$C_4H_9, C N.$	.0011380. 0°-50°.	Erlenmeyer & Hell. A. C. P. 160. 257. Intermediate values given.
" "	"	.0012439. 0°-100°.	
" "	"	.0012577. 0°-120°.	
Allyl "	$C_3H_5, C N.$	.0014315. 0°-95°.	Lieke. A. C. P. 112. 319.
Phenyl "	$C_6H_5, C N.$	.000961. 0°-100°.	Kopp. 35. Third paper. Intermediate values given.
" "	"	.0011045. 0°-200°.	
Aniline, or phenyl-amine.	$C_6H_7, N.$	.000915. 0°-100°.	Kopp. 35. Third paper. Intermediate values given.
" "	"	.0010147. 0°-190°.	
Coniine. Natural.	$C_8H_{15}, N.$	.001011. 0°-90°.	Schiff. A. C. Phys. (5). 1. 143.
" Artificial.	"	.0009333. "	
Ethyl nitrate.	$C_2H_5, N O_3.$	.0014111. 0°-90°.	Kopp. 35. Third paper. Intermediate values given.

Name.	Formula.	Coëff. of Expansion.	Authority.
Butyl nitrate.	$C_4 H_9 N O_3$	.001666. $0^\circ-50^\circ$.	Chapman & Smith. C. S. J. 22. 153.
Nitrobenzol.	$C_6 H_5 N O_2$	.000892. $0^\circ-100^\circ$.	Kopp. 35. Third paper. Intermediate values given.
"	"	.0010082. $0^\circ-220^\circ$.	

XV. CHLORINATED ORGANIC COMPOUNDS.

Name.	Formula.	Coëff. of Expansion.	Authority.
Ethyl chloride.	$C_2 H_5 Cl$.001435355. $-31^\circ.63$.	Pierre. 20.
" "	"	.001660556. $26^\circ.41$.	
" "	"	.001574578. 0° .	Pierre. 26.
" "	"	.001642177. 11° .	
" "	"	.001482. 0° .	Drion. A. C. Phys. (3). 56. 5. Value given for every 10° .
" "	"	.002045. 50° .	
" "	"	.003250. 100° .	
" "	"	.005031. 130° .	
Propyl "	$C_3 H_7 Cl$.0013888. $0^\circ-25^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234.
" "	"	.0014645. $0^\circ-46^\circ.5$.	
Butyl "	$C_4 H_9 Cl$.0013360. $0^\circ-50^\circ$.	Pierre & Puchot. A. C. Phys. (4). 22. 234.
" "	"	.0014217. $0^\circ-69^\circ$.	
Amyl "	$C_5 H_{11} Cl$.001173742. 0° .	Pierre. 26.
" "	"	.001362651. $101^\circ.75$.	
" "	"	.001171550. 0° .	Pierre. 30.
" "	"	.001693327. $101^\circ.75$.	
Diethyl carbinol chloride.	"	.00111. $0^\circ-21^\circ$.	Wagner & Saytzeff. A. C. P. 179. 321.
Amylene hydrochlorate.	"	.00113.	
Methylene chloride.	$C H_2 Cl_2$.00137. $0^\circ-20^\circ$.	Butlerow. J. 22. 343.
Ethylene "	$C_2 H_4 Cl_2$.001084043. -30° .	Pierre. 24.
" "	"	.001118932. 0° .	
" "	"	.001530055. $84^\circ.92$.	
Butylene "	$C_4 H_8 Cl_2$.0011940. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
" "	"	.0012392. $0^\circ-130^\circ$.	
Chloroform.	$C H Cl_3$.001107146. 0° .	Pierre. 26.
"	"	.001488703. $63^\circ.5$.	

Name.	Formula.	Coeff. of Expansion.	Authority.
Chloroform.	C H Cl_3 .	.001488689. $63^\circ.5$.	Pierre. 30.
Chlorinated ethyl chloride.	$\text{C}_2 \text{ H}_4 \text{ Cl}_2$.	.001290718. 0° .	} Pierre. 26 & 29.
" " "	"	.001544953. $64^\circ.8$.	
Dichlorinated " "	$\text{C}_2 \text{ H}_2 \text{ Cl}_2$.	.001174820. 0° .	} Pierre. 26 & 29.
" " "	"	.001611246. $74^\circ.9$.	
Chlorinated ethylene chloride.	$\text{C}_2 \text{ H}_2 \text{ Cl}_2$.	.001056414. 0° .	} Pierre. 29.
" " "	"	.001399361. 100° .	
" " "	"	.001431592. $114^\circ.2$.	Pierre. 28.
Dichlorinated " "	$\text{C}_2 \text{ H}_2 \text{ Cl}_4$.	.000835620. 0° .	} Pierre. 30.
" " "	"	.001335024. $138^\circ.6$.	
Pentachloro dimethyl.	$\text{C}_2 \text{ H Cl}_5$.	.000899044. 0° .	} Pierre. 30.
" " "	"	.001452752. $153^\circ.8$.	
Monochloro benzol.	$\text{C}_6 \text{ H}_5 \text{ Cl}$.	.00116.	Jungfleisch. J. 21. 343.
Trichlorobenzol. L.	$\text{C}_6 \text{ H}_3 \text{ Cl}_3$.	.000989.	" J. 21. 350.
Chloral.	$\text{C}_2 \text{ H Cl}_2 \text{ O}$.	.001298. $0^\circ-100^\circ$.	Kopp. 35. Second paper. Intermediate values given.
Acetyl chloride.	$\text{C}_2 \text{ H}_3 \text{ Cl O}$.	.0015167. $0^\circ-60^\circ$.	Kopp. 35. Second paper. Intermediate values given.
Epichlorhydrin.	$\text{C}_2 \text{ H}_5 \text{ Cl O}$.	.0006996. $0^\circ-50^\circ$.	Darmstädter. J. 21. 454.
Benzoyl chloride.	$\text{C}_7 \text{ H}_5 \text{ Cl O}$.	.000930. $0^\circ-100^\circ$.	} Kopp. 35. Second paper. Intermediate values given.
" "	"	.001056. $0^\circ-200^\circ$.	

XVI. BROMINATED ORGANIC COMPOUNDS.

Name.	Formula.	Coëff. of Expansion.	Authority.
Methyl bromide.	$C H_3 Br.$	.001408318. $-34^{\circ}.64.$	Pierre. 20.
" "	"	.001576164. $27^{\circ}.76.$	
" "	"	.001415206. $0^{\circ}.$	
" "	"	.001559038. $13^{\circ}.$	Pierre. 21 & 26.
Ethyl "	$C_2 H_5 Br.$	.001265548. $-31^{\circ}.87.$	
" "	"	.001490748. $53^{\circ}.66.$	Pierre. 20.
" "	"	.001290277. $-30^{\circ}.$	
" "	"	.001337628. $0^{\circ}.$	Pierre. 21 & 26.
" "	"	.001540060. $40^{\circ}.7.$	
Propyl "	$C_3 H_7 Br.$	.001318. $0^{\circ}-50^{\circ}.$	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
" "	"	.001393. $0^{\circ}-72^{\circ}.$	
Butyl "	$C_4 H_9 Br.$	.001234. $0^{\circ}-50^{\circ}.$	Pierre & Puchot. A. C. Phys. (4). 22. 234. Inter- mediate values given.
" "	"	.001325. $0^{\circ}-90^{\circ}.5.$	
Amyl "	$C_5 H_{11} Br.$	.001023212. $0^{\circ}.$	Pierre. 26.
" "	"	.001602729. $118^{\circ}.7.$	
" "	"	.001596728. $118^{\circ}.7.$	Pierre. 30.
Ethylene "	$C_2 H_4 Br_2.$	.000952696. $20^{\circ}.09.$	Pierre. 24 & 26.
" "	"	.001182181. 100°	
" "	"	.001453206. $132^{\circ}.6.$	
Propylene "	$C_3 H_6 Br_2.$	.001785. $0^{\circ}-20^{\circ}.$	Friedel & Ladenburg. B. S. C. 8. 146. Prepared by two processes.
" "	"	.001805. "	
Methylbromacetol.	"	.001620. $0^{\circ}-20^{\circ}.$	Friedel & Ladenburg. B. S. C. 8. 150.
Butylene bromide.	$C_4 H_8 Br_2.$	.00082. $0^{\circ}-20^{\circ}.$	Grabowsky & Saytzeff. A. C. P. 179. 332.
Amylene "	$C_5 H_{10} Br_2.$	.00093. $0^{\circ}-14^{\circ}.$	Wagner & Saytzeff. A. C. P. 179. 308.
Allyl bromide.	$C_3 H_5 Br.$	.0007136. $0^{\circ}-15^{\circ}.$	Tollens. J. F. P. 107. 185.
" "	"	.0011848. $15^{\circ}-62^{\circ}.$	
Bromodichlorhydrin of propyl phycite.	$C_3 H_5 Br Cl_2 O.$	.000782. $3^{\circ}.1-17^{\circ}.5.$	Wolf. B. S. C. 13. 150.
" "	"	.000869. $17^{\circ}.5-36^{\circ}.$	
" "	"	.000894. $36^{\circ}-53^{\circ}.$	
" "	"	.000899. $86^{\circ}-100^{\circ}.5.$	
" "	"	.000895. $3^{\circ}.1-100^{\circ}.5.$	

XVII. ORGANIC IODINE COMPOUNDS.

Name.	Formula.	Coeff. of Expansion.	Authority.
Methyl iodide.	C_2H_5I	.001150866. -35° .43.	Pierre. 20.
" "	"	.001360369. 61° .52.	
" "	"	.001085098. -35° .	Pierre. 21.
" "	"	.001199591. 0° .	
" "	"	.001446938. 43° .8.	
Ethyl "	C_4H_9I	.001074754. 34° .81.	Pierre. 20.
" "	"	.001264140. 71° .86.	
" "	"	.001018046. -30° .	Pierre. 21.
" "	"	.001142251. 0° .	
" "	"	.001480311. 70° .	
Propyl "	C_3H_7I	.001120. 0° - 50° .	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
" "	"	.001250. 0° - 100° .	
" "	"	.0012631. 0° - 104° .5.	
Butyl "	C_4H_9I	.001078. 0° - 50° .	Pierre & Puchot. A. C. Phys. (4). 22. 234. Vol. given at intermediate temperatures.
" "	"	.001166. 0° - 100° .	
" "	"	.0012082. 0° - 122° .5.	
" "	"	.00106182. 0° - 50° .	De Luynes. J. 17. 499. Vol. given for every 10° .
" "	"	.00112499. 0° - 90° .	
Isobutyl "	"	.0010666. 0° - 50° .	Erlenmeyer & Hell. A. C. P. 160. 257. Inter- mediate values given.
" "	"	.0011601. 0° - 100° .	
" "	"	.0011903. 0° - 120° .	
Amyl "	$C_5H_{11}I$.001112. 0° - 100° .	Kopp. 35. Second paper. Intermediate values given.
" "	"	.001204. 0° - 150° .	
Diethyl carbinol iodide.	"	.00089. 0° - 20° .	Wagner & Saytzeff. A. C. P. 179. 318.
Amylenehydri- date.	"	.00097. 0° - 20° .	
Hexyl iodide. β .	$C_6H_{13}I$.00092. 0° - 50° .	Wanklyn & Erlenmeyer. J. 16. 518.
Methylene "	$C_2H_4I_2$	.0008316. a . 5° - 95° .

XVIII. ORGANIC COMPOUNDS CONTAINING SULPHUR.

Name.	Formula.	Coëff. of Expansion.	Authority.
Ethyl sulphide.	$C_4H_{10}S$.	.001196426. 0° .	} Pierre. 26.
" "	"	.001721026. 91° .	
Methyl disulphide.	$C_2H_4S_2$.	.001017049. 0° .	} Pierre. 26.
" "	"	.001440298. $112^\circ.1$.	
" "	"	.000941822. 0° .	Pierre. 30.
Amyl mercaptan	$C_5H_{12}S$.	.001220. $0^\circ-100^\circ$.	} Kopp. 35. Second paper. Intermediate values given.
" "	"	.0012617. $0^\circ-120^\circ$.	
Ethyl sulphite.	$C_4H_{10}SO_3$.	.000990479. 0° .	} Pierre. 25.
" "	"	.001257739. 100° .	
" "	"	.001461725. $160^\circ.3$.	} Carius. J. F. P. (2). 2. 279. Other values given.
" "	"	.0011110. $0^\circ-100^\circ$.	
" "	"	.0012486. $0^\circ-161^\circ.3$.	} Carius. J. F. P. (2). 2. 279. Other values given.
" ethylsulpho- nate.	$C_4H_{10}SO_3$.	.0009580. $0^\circ-100^\circ$.	
" "	"	.0011265. $0^\circ-213^\circ.4$.	
Methyl sulpho- cyanide.	CH_3CNS .	.000970072. 0° .	} Pierre. 26 & 30.
" "	"	.001494627. $132^\circ.86$.	
Allyl "	$C_3H_5CN S$.	.0011480. $0^\circ-100^\circ$.	} Kopp. 35. Third paper. Intermediate values given.
" "	"	.0012413. $0^\circ-150^\circ$.	
Chlorosulphuric ether.	$C_2H_5ClSO_3$.	.0006393. $0^\circ-27^\circ$.	} Purgold. J. 21. 416.
" "	"	.0007155. $27^\circ-61^\circ$.	

XIX. METALLIC SALTS OF ORGANIC ACIDS.

Name.	Formula.	Coëff. of Expansion.	Authority.
Potassium oxal- ate.	$K_2C_2O_4 \cdot H_2O$.	.0001162. $0^\circ-100^\circ$.	Playfair & Joule. 27.
Ammonium "	$Am_2C_2O_4 \cdot H_2O$.	.0000876. "	" " "

Name.	Formula.	Coëff. of Expansion.	Authority.
Potassium binoxalate.	$\text{K H C}_2\text{O}_4$.	.00011338. 0° – 100° .	Playfair & Joule. 27.
Ammonium "	$\text{Am HC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.	.00013718. "	" " "
Potassium quadroxalate.	$\text{KH}_3\text{C}_4\text{O}_8 \cdot 2\text{H}_2\text{O}$.	.0015916. "	" " "
Ammonium "	$\text{Am H}_3\text{C}_4\text{O}_8 \cdot \text{H}_2\text{O}$.	.00014347. "	" " "

XX. MISCELLANEOUS ORGANIC COMPOUNDS.

Name.	Formula.	Coëff. of Expansion.	Authority.
Lead tetramethyl.	$(\text{CH}_3)_4\text{Pb}$.	.004137. 0° – 100° .	Butlerow. J. 16. 476.

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" anhydride	42	Ammonium. Chloride	25	" Sulphate. <i>Cubi-</i>	31
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" Nitric	31	Amylene. Bromide	50	Bronze	20
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SMITHSONIAN MISCELLANEOUS COLLECTIONS.

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PHOTOGRAPHIC PORTRAITS

OF

NORTH AMERICAN INDIANS

IN THE GALLERY OF THE

SMITHSONIAN INSTITUTION.



WASHINGTON:
SMITHSONIAN INSTITUTION.
1867.



PHOTOGRAPHIC PORTRAITS
OF
NORTH AMERICAN INDIANS

IN THE GALLERY OF THE
SMITHSONIAN INSTITUTION.

N B.—The Yankton Sioux at present reside on a reservation on the Missouri River, in Dakota Territory, opposite Fort Randall.

PA-DA-NI-A-EA-HI, **1** **STRUCK BY THE REE.**
Head Chief of the Yankton Sioux. Dakota T.
Upper Missouri, Dak. T. A. Zeno Shindler, photog.,
Washington, 1867.

PSI-CA-NA-KIN-YAN. **2** **JUMPING THUNDER.**
A Yankton Sioux Chief.
Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

WI-YA-KO-MI, **3** **FEATHER IN THE EAR.**
A Yankton Sioux Chief.
Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

MA-GA-SKAN, **4** **WHITE SWAN.**
A Yankton Sioux Chief.
Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

4

TO-KAN-WAS-TE,

5

THE PRETTY ROCK.

Son of a Yankton Sioux Chief.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

6

WA-JIN-KA,

LITTLE BIRD.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

7

TO-KA-O-NO-PA,

THE ONE WHO CATCHES THE ENEMY.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

8

PTE-YAH-PA-MA-SA,

THE IRON BLACK BIRD.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

9

KNA-SKIN-YA MA-NI,

HE WALKS MAD.

A Head-Soldier of the Yankton Sioux.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

10

WAN-MDI-SA-PA,

BLACK EAGLE.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

11

WO-A-KI-A-TSI-KAN,

LITTLE THUNDER.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

12

SI-HA-HAN-SKA.

LONGFOOT.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

13

FRANCIS JANDRON,

HALF-BREED.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

14

MA-TO-KTI-NANG-MA-NI. THE BEAR THAT WALKS LYING
[DOWN.

A Yankton Sioux Brave.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

15

TA-TSAN-OP-KI-AN.

FLYING PIPE.

A Head-Soldier of the Yankton Sioux.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

16

DELAURIER,

HALF-BREED.

A Yankton Sioux Chief.

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

17

TA-TA-KA-WA-KAN,

SACRED BULL.

Brulé Chief.

Dakota.

Shindler, photog., Washington, 1867.

18

SE-TAN-SI-TAN,

YELLOW HAWK.

Sans Arc Chief.

Dakota.

Shindler, photog., Washington, 1867.

19

SE-TAN-SI-TAN,

YELLOW HAWK.

Sans Arc Chief.

Dakota.

Shindler, photog., Washington, 1867.

20

MA-ZA-O-YA-TI,

IRON NATION.

Brulé Chief.

Dakota.

Shindler, photog., Washington, 1867.

21

KAH-KAH-TAH-A-KE-AH, THE FLYING BIRD.
A Two-Kettle Sioux Chief. *

Dakota. Shindler, photog., Washington, 1867.

22

MA-TA-WA-YU-MI, THE BEAR THAT FRIGHTENS.
A Yankton Sioux Brave. †

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

23

MA-TA-WA-YU-MI. THE BEAR THAT FRIGHTENS.
A Yankton Sioux Brave. †

Upper Missouri, Dak. T. Shindler, photog., Washington, 1867.

24

CHUN-KAN-KE-TES-KA, THE SPOTTED HORSE.
A Two-Kettle Sioux Chief.

Dakota. Shindler, photog., Washington, 1867.

25

TO-KI-YA-WI-KA-KTE, HE KILLS FIRST.
Mini-Conjou Chief.

Dakota. Shindler, photog., Washington, 1867.

26

NA-JI-WA-KAN, THE SACRED GHOST.
A Two-Kettle Sioux Brave. *

Dakota. Shindler, photog., Washington, 1867.

27

MA-TO-HO-KAN-TAN-KE, THE BEAR WITH THE BIG VOICE.
A Two-Kettle Sioux Chief.

Dakota. Shindler, photog., Washington, 1867.

* Are two of the eleven Indians that recovered Mrs. Julia Fright, Miss Emma Duley, and six children, from hostile Indians, near the mouth of the Grand River, in November, 1862.

† Guide to Gen. A. Sully's military expedition through the "Bad Lands" of Dakota. Having been shot through the breast by the hostile Indians, while in an almost dying condition, he guided the entire force of military safely through that country.

28

MA-TO-HO-KAN-TAN-KE, THE BEAR WITH THE BIG VOICE.

A Two-Kettle Sioux Chief.

Dakota.

Shindler, photog., Washington, 1867.

29

MA-VA-TA-NA-HAN-SKA,

LONG MANDAN.

A Two-Kettle Sioux Chief.

Dakota.

Shindler, photog., Washington, 1867.

30

PTE-WA-KAN-NA-GI,

THE MEDICINE COW.

A Yankton Sioux Chief.

Upper Missouri, Dak. T.

Shindler, photog., Washington, 1867.

31

MA-TA-SA-BE-ZI-A.

THE SMUTTY BEAR.

A Yankton Sioux Chief.

Upper Missouri, Dak. T.

Shindler, photog., Washington, 1867.

32

TOW-A-HU-KA-SA-NO-PA,

TWO LANCES.

A Yankton Sioux Chief.

Upper Missouri, Dak. T.

Shindler, photog., Washington, 1867.

33

WA-PA-SHA,

RED ENSIGN.

Chief of the Ki-gu-ksa Band. (Santee Sioux.)

Age, 50 years.

Dakota.

Shindler, photog., Washington, 1867.

34

CHO-TAN-KA-SI-DI-NA-PE,

THE FLUTE PLAYER.

Head Man of the Wâk-pe-ton Dakota. (Santees.)

Age, 46 years.

Dakota.

Shindler, photog., Washington, 1867.

35

WA-KA-TE,**THE SHOOTER.**

Chief of the Re-mi-ni-ca Band. (Santees.)

Age, 45 years.

Dakota.

Shindler, photog., Washington, 1867.

36

HU-SHA-SHA,**RED LEGS.**

Chief of the Wak-pe-ka-te. (Santees.)

Age, 55 years.

Dakota.

Shindler, photog., Washington, 1867.

37

HAN-YE-TU-DU-TA,**SCARLET NIGHT.**

Head Man of the Re-mi-ni-ca Band. (Santees.)

Age, 37 years.

Dakota.

Shindler, photog., Washington, 1867.

38

WA-MDI-KA-WA-MA-NI,**HE WALKS FOLLOWING EAGLES.**

Wa-pa-shee Chief of Santees.

Age, 14 years.

Dakota.

Shindler, photog., Washington, 1867.

39

WA-KAN-HDI-SA-PA,**BLACK LIGHTNING.**

Man of Ri-ga-ta-a-ta-wa Band. (Santees.)

Age, 34 years

Dakota.

Shindler, photog., Washington, 1867.

40

ZI-KA-TAN-TO,**BLUE BIRD.**

Wak-pe-ton Band. (Santees.)

Age, 20 years.

Dakota.

Shindler, photog., Washington, 1867.

41

JUS-UN-KE-MA-ZA,**HIS MAN HORSE.**

Man of Ca-po-cia Band. (Santees.)

Dakota.

Shindler, photog., Washington, 1867.

42

O-WAN-SA DU-TA, SCARLET ALL OVER.
 Chief of the Re-ga-ta O-tou-we Band. (Santees.)
Dakota. Shindler, photog., Washington, 1867.

43

MOK-PI-YU-E-HUA-KU-DAN, COMING AMONG THE CLOUDS.
 Wak-pe-ton Band. (Santees.)
 Age, 18 years.
Dakota. Shindler, photog., Washington, 1867.

44

A-KI-CI-TAN-NA-JIN, THE STANDING SOLDIER.
 Man of the Ca-po-cia Band. (Santees.)
 Age, 39 years.
Dakota. Shindler, photog., Washington, 1867.

45

WAK-PI-YU-HDI-NA-JIN, THE STANDING CLOUD.
 Man of the Re-ga-ta O-tou-we Band. (Santees.)
Dakota. Shindler, photog., Washington, 1867.

46

WA-KAN-NA. THE SACRED.
 Man of the Wak-pe-ku-te Band. (Santees.)
 Age, 18 years.
Dakota. Shindler, photog., Washington, 1867.

47

JOHN ROSS.
 Head Chief of the Cherokees.
 Died in Washington, Aug. 1866.
Indian T. west of Ark. Shindler, photog., Washington, 1868.

48

TSHE-TON WA-KA-WA MA-NI, THE HAWK THAT HUNTS
 [WALKING; or, LITTLE CROW.
 A Mde-wa Kan-ton Sioux.
 Chief Leader of the Massacre in Minnesota, 1862. (Killed.)
Dakota. Shindler, photog., Washington, 1868.

49

O-TO-WA,**THE SUCKER.**

A Po-to-wa-ta-mi Councillor.

Kansas.

Shindler, photog., Washington, 1858.

50

WI-GA-SA-PI,**THE WHIP.**

A Chief of the Ponchas.

Dakota.

Shindler, photog., Washington, 1858.

51

HIN-HAN-DU-TA,**THE RED OWL.**

A Chief of the Mde-wa-kan-ton Sioux.

Dakota.

Shindler, photog., Washington, 1858.

52

WZHI-KIAN,**THUNDER COMING DOWN TO THE GROUND**

A Po-to-wa-ta-mi Councillor.

Kansas.

Shindler, photog., Washington, 1858.

53

UPI-T-YA-HDE-A,**TAIL-FEATHER JOINED.**

A Wa-pe-ton Sioux Chief.

Dakota.

Shindler, photog., Washington, 1858.

54

MA-ZA-KA-TE-MANI, HE THAT SHOOTS MEDALS WALKING.

A Wa-pe-ton Sioux Elective Chief.

Dakota.

Shindler, photog., Washington, 1858.

55

WA-MDI TAN-KA,**THE GREAT EAGLE.**

A Mde-wa-kan-ton Sioux Chief.

Dakota.

Shindler, photog., Washington, 1858.

56

AT-PE-TU-TO KA-TSHA,**THE OTHER DAY.**

A Wa-pe-ton Sioux Warrior.

Dakota.

Shindler, photog., Washington, 1858.

57

HE-HU-TE-DAN, **LITTLE SHORT HORN.**
 A Si-si-ton Sioux Warrior.
Dakota. Shindler, photog., Washington, 1858.

58

PSI-KA-WA-KIN-YAN, **JUMPING THUNDER.**
 A Yankton Sioux Warrior.
Dakota. Shindler, photog., Washington, 1858.

59

A-HA-KA MA-NI, **THE WALKING ELK.**
 A Yankton Sioux Warrior.
Dakota. Shindler, photog., Washington, 1858.

60

MA-ZHA O ZHA-ZHAN, **TRANSPARENT IRON.**
 A Mde-wa-kan-ton Sioux Chief.
Dakota. Shindler, photog., Washington, 1858.

61

MO-KA HO KA, **FISH RISING ABOVE THE WATER.**
 Principal Chief of the Sacs and Foxes.
Kansas. Shindler, photog., Washington, 1858

62

NE-SHA-DU SI-DI TE-ZI-KA, **THE CHIEF WHOM THEY LOOK**
[UPON.]
 Principal Chief of the Republican Pawnees.
Nebraska. Shindler, photog., Washington, 1858.

63

NA-SA-WA-KWUT, **THE BEAR IN THE FORK OF A TREE.**
 Principal Chief of the Sacs and Foxes.
Kansas. Shindler, photog., Washington, 1858.

64

PI-TA-NE-SHA-A-DU, **MAN-AND-CHIEF.**
 Principal Chief of the Pawnees.
Nebraska. Shindler, photog., Washington, 1858.

65

LA-HAK-TAN-DU-HE-SHA A-DU, MEDICINE PIPE CHIEF.
 Chief of the Grand Pawnees.
Nebraska. Shindler, photog., Washington, 1858.

66

NE-SHA-RE-RU-RE-RA HI-KUTE, THE BRAVE CHIEF.
 A Republican Pawnee Chief.
Nebraska. Shindler, photog., Washington, 1858.

67

HE-HA KA MAZA, IRON ELK.
 A Mde-wa-kan-ton Sioux Warrior.
Dakota. Shindler, photog., Washington, 1858.

68

PUG-A-NO-KE-SHICK, HOLE IN THE DAY.
 Head Chief of the Chippewas.
Minnesota. Shindler, photog., Washington, 1858.

69

HE-KA-KA NANG-ZHE THE STANDING ELK.
 A Yankton Sioux Warrior.
Dakota. Shindler, photog., Washington, 1858.

70

LA-KA-KO, THE GRAY FOX.
 A Chief of the Sacs and Foxes.
Kansas. Shindler, photog., Washington, 1858.

71

SHA-KPI, SIX.
 A Mde-wa-kan-ton Sioux Chief.
Dakota. Shindler, photog., Washington, 1858.

72

OH-LACH-TA MIKO, BILLY BOWLEGS.
 A Seminole Chief.
Indian T. west of Ark. Shindler, photog., Washington, 1858.

73

TI-RO-WOT-KA-TO-HUK,**THE CONQUEROR.**

A Grand Pawnee Chief.

Nebraska.

Shindler, photog., Washington, 1858.

74

LA-TANG-KA-YANG-KE,**THE RUNNING BULL.**

A Yankton Sioux Warrior.

Dakota.

Shindler, photog., Washington, 1858.

75

KI-NI-I-KA,**BUFFALO BULL.**

A Grand Pawnee Warrior.

Nebraska.

Shindler, photog., Washington, 1858.

76

PA-DA-NO-A-PA-PE.**HE WHOM A ROCKAWEE STRUCK.**

Head Chief of the Yankton Sioux.

Dakota.

Shindler, photog., Washington, 1858.

77

BATTLE BETWEEN PONKAS AND SIOUX.

Painted by TO-TAY-GO-NAL (STANDING BUFFALO), a young Ponka Warrior.

78

COL. PITCHLYNN.

A Choctaw Delegate.

Choctaw Nation.

Shindler, photog., Washington, 1868.

79

REV. ISRAEL FOLSON.

A Choctaw Delegate.

Choctaw Nation.

Shindler, photog., Washington, 1868.

80

A CHIEF OF THE OSAGE INDIANS.**Kansas.**

Shindler, photog., Washington, 1868.

81

GROUP OF CHEYENNE INDIAN CHIEFS.**Nebraska.**

Shindler, photog., Washington, 1868.

82

SOBITA.Head Chief of the Capote Utas, and Brother of
Carrisa, Head Chief of the Utas, Colorado T.**New Mexico.**

Shindler, photog., Washington, 1868.

83

SHINO and MANULITO.

Chiefs of the Navajo Indians.

New Mexico.

Shindler, photog., Washington, 1868.

84

NI-CO-ROD,**GREEN LEAF.**

A Uta Chief.

Colorado.

Shindler, photog., Washington, 1868.

85

PE-A-OH,**BLACK-TAIL DEER.**

A Uta Chief.

Colorado.

Shindler, photog., Washington, 1868.

86

SHU-RI-PI,**LODGE POLE'S SON.**

A Uta Chief.

Colorado.

Shindler, photog., Washington, 1868.

87

CHIP-PIN,**ALWAYS RIDING.**

A Uta Chief.

Colorado.

Shindler, photog., Washington, 1868.

88

KE-O-KUK.

Head Chief of the Sacs.

Kansas.

Shindler, photog., Washington, 1868.

89

WA-COM-MO.

A Brave of the Foxes.

Kansas.

Shindler, photog., Washington, 1868.

90

CHE-KO-SKUK

Head Chief of the Foxes.

Kansas.

Shindler, photog., Washington, 1868.

91

MO-KO-HO-KO,

FISH RISING ABOVE THE WATER.

A Chief of the Sacs.

Kansas.

Shindler, photog., Washington, 1868.

92

UK-WKA-HO-KO,

FISH FLOATING TO THE SHORE.

A Chief of the Sacs.

Kansas.

Shindler, photog., Washington, 1868.

93

PA-TEK-KWA.

A Chief of the Sacs.

Kansas.

Shindler, photog., Washington, 1868.

94

GROUP OF FOUR PONKA CHIEFS.

No. 1. ASH-NOM-E-KAH-GA-HE, LONE CHIEF.

" 2. TA-TON-GA, UN-ZHE, STANDING BUFFALO.

" 3. WAH-GA-SA-PI, THE IRON WHIP.

" 4. WAST-EH-COM-MA-NI, FAST WALKER.

Dakota.

Shindler, photog., Washington, 1868.

95

OU-MA-TA A-BI-TU-TA,

WAR EAGLE.

An O-ga-la-la Chief.

Dakota.

Shindler, photog., Washington, 1868.

COL. LEWIS DOWNING.

Head Chief of the Cherokees.

Cherokee Nation. Shindler, photog., Washington, 1868.

CAPT. SCRAPER.

A Cherokee Delegate.

Cherokee Nation. Shindler, photog., Washington, 1868.

J. BORUM DAVIS.

A Cherokee Delegate.

Cherokee Nation. Shindler, photog., Washington, 1868.

SAMUEL SMITH.

A Cherokee Delegate.

Cherokee Nation. Shindler, photog., Washington, 1868.

COL. ADAIR.

A Cherokee Delegate.

Cherokee Nation. Shindler, photog., Washington, 1868.

H. C. REESE.

A Cherokee Delegate.

Cherokee Nation. Shindler, photog., Washington, 1868.

FAUNCEWAY BATTICE.

A Choctaw Delegate.

Choctaw Nation. Shindler, photog., Washington, 1868.

WAR DANCE OF THE YANKTON SIOUX.

Dakota. Shindler, photog., Washington, 1867.

104

GROUP OF FOUR UTAH INDIANS. See Nos. 84, 85, 86, 87.
Colorado. Shindler, photog., Washington, 1868.

105

S. W. PERRYMAN.
 A Creek Delegate.

106

G. W. STIDHAM.
 A Creek Delegate.

107

AMBROSIO ABETA,* EX-GOVERNOR OF ISLETA.
 Pueblo Indian.
New Mexico. Shindler, photog., Washington, 1868.

108

ALEJANDRO PADILLA, GOVERNOR OF ISLETA.
 Pueblo Indian.
New Mexico. Shindler, photog., Washington, 1868.

109

PAH-DO-KAH-GAH-LE.
 A Kaw or Kansas Indian.
Kansas. A. Gardner, photog., Washington, 1867.

110

KAK-HE-GAH-SHA.
 Kaw Indian.
Kansas. A. Gardner, photog., Washington, 1867.

111

NO-PA-WY.
 Kaw Indian.
Kansas. A. Gardner, photog., Washington, 1867.

* Abeita is seventy-eight years of age, and very wealthy. During the rebellion he loaned to the government officials in New Mexico one hundred thousand dollars in gold and silver to pay our troops stationed there.

AH-LE-GA-WAH.**112**

Kaw Indian.

Kansas.

A. Gardner, photog., Washington, 1867.

ISH-TA-LA-SEA.**113**

Kaw Indian.

Kansas.

A. Gardner, photog., Washington, 1867.

WA-TE-IN-GAH.**114**

Kaw Indian.

Kansas.

A. Gardner, photog., Washington, 1867.

KAH-DE-GAH-WAH-TE-AN-GAH HO.**115**

Kaw Indian.

Kansas.

A. Gardner, photog., Washington, 1867.

WA-KA-TE,**116****THE SHOOTER.**

A Santee Chief.

A. Gardner, photog., 1867.

MA-TO-KTI-NANG-MA-NI,**117****THE BEAR THAT LIES DOWN.**

A Yankton Sioux Brave.

Dakota.

A. Gardner, photog., Washington, 1867.

WAN-MDI-SA-PA,**118****BLACK EAGLE.**

A Yankton Sioux Brave.

Dakota.

A. Gardner, photog., Washington, 1867.

KE-O-KUK.**119**

Head Chief of the Sacs.

A. Gardner, photog., Washington, 1867.

120**MA-ZA-O-YA-TI,****IRON NATION.**

Head Chief of the Brulé Sioux.

Dakota.

A. Gardner, photog., Washington, 1867.

121

[Name lost.]

A. Gardner, photog., Washington, 1867.

122**PTE-WA-KAN-NAGI,****MEDICINE COW.**

A Yankton Sioux Chief.

A. Gardner, photog., Washington, 1867.

123**SE-TAN SI-TAN,****YELLOW HAWK.**

A Sans Arc Chief.

Upper Missouri.

A. Gardner, photog., Washington, 1867.

124**WA-BA-SHA,****RED ENSIGN.**

Head Chief of the Santee Sioux.

A. Gardner, photog., Washington, 1867.

125**MA ZA-O-YA-TI,****IRON NATION.**

Head Chief of the Brulé Sioux.

A. Gardner, photog., Washington, 1867.

126**MA-VA-TA-NA HANS-KA,****LONG MANDAN.**

Head Chief of the Kettle Sioux.

Dakota.

A. Gardner, photog., Washington, 1867.

127**WA-JIN-KA and SI-HA-HAN-SKA, THE BIRD, AND LONG FOOT.**

Yankton Sioux Brave.

Dakota.

A. Gardner, photog., Washington, 1867.

128

WA-JIN-KA, **THE BIRD.**
 Yankton Sioux Brave.
Dakota. A. Gardner, photog., Washington, 1867.

129

SI-HA-HAN-SKA, **LONG FOOT.**
 Yankton Sioux Brave.
Dakota. A. Gardner, photog., Washington, 1867.

130

SI-HA-HAN-SKA, **LONG FOOT.**
 Yankton Sioux Brave.
Dakota. A. Gardner, photog., Washington, 1867.

131

HAL-AL-HO-SOTE, **LAWYER.**
 Head Chief of the Nez-Percez.
Idaho. Shindler, photog., Washington, 1868.

132

KOL-KOL-SHU-A-TASH, **JASON.**
 Chief of the Nez-Percez.
Idaho. Shindler, photog., Washington, 1868.

133

TA-MO-SON, **TIMOTHY.**
 Chief of the Nez-Percez.
Idaho Shindler, photog., Washington, 1868.

131^a

SAMPSON FOLSOM.
 A Choctaw Delegate.
Shindler, photog., Washington, 1868.

132^a

PI-SING, **GAME.**
 A Kaw Indian.
Kansas. Shindler, photog., Washington, 1868.

133a**PL-SING,****GAME.****A Kaw Indian.****Kansas.**

Shindler, photog., Washington, 1868.

134**A Navajo Chief.****New Mexico.**

Copied by Shindler, Washington, 1868.

135**A Navajo Boy.****New Mexico.**

Copied by Shindler, Washington, 1868.

136**Two Navajo Boys.****New Mexico.**

Copied by Shindler, Washington, 1868.

137**A Navajo Chief.****New Mexico.**

Copied by Shindler, Washington, 1868.

138**A Sioux Indian.****Kansas.**

Copied by Shindler, Washington, 1868.

139**PO-NE-NO-PA-SHE,****JOSEF.****Chief of the Big Hill Band, Osage Tribe.****Kansas.**

Copied by Shindler, Washington, 1868

140**WO-HA-AR-BAR.****An Osage Brave.****Kansas.**

Copied by Shindler, Washington, 1868.

141

An Osage Chief.

Kansas.

Copied by Shindler, Washington, 1868.

142

NO-PA-WAL-LA.

An Osage Brave.

Kansas.

Copied by Shindler, Washington, 1868.

143

A Group of Osages.

Kansas.

Copied by Shindler, Washington, 1868.

144

A Choctaw Squaw.

Kansas.

Copied by Shindler, Washington, 1868.

145

A Creek Indian.

Kansas.

Copied by Shindler, Washington, 1868.

146

A Choctaw Indian.

Kansas.

Copied by Shindler, Washington, 1868.

147

A Choctaw Indian.

Kansas.

Copied by Shindler, Washington, 1868.

148

Two Choctaw Indians.

Kansas.

Copied by Shindler, Washington, 1868.

149

A Camanche Chief.

Texas.

Copied by Shindler, Washington, 1868.

150

A Camanche Girl.

Texas.

Copied by Shindler, Washington, 1868.

151

Two Choctaw Girls.

Kansas.

Copied by Shindler, Washington, 1868.

152

A Chickasaw Indian.

Kansas.

Copied by Shindler, Washington, 1868.

153

An Osage Chief.

Kansas.

Copied by Shindler, Washington, 1868.

154

Four Arrapahoe Chiefs.

Copied by Shindler, Washington, 1868.

155

A Choctaw Indian.

Kansas.

Copied by Shindler, Washington, 1868.

156

KO-SHE-SE-GLO.

An Osage Brave.

Kansas.

Copied by Shindler, Washington, 1868.

157

An Osage Brave.

Kansas.

Copied by Shindler, Washington, 1868.

158

KEO-KUK, Senior, WATCHFUL FOX.
 Head Chief of the Sacs and Foxes.
Kansas. Copied by Shindler, Washington, 1868.

159

KEO-KUK, Junior, WATCHFUL FOX.
 Head Chief of the Foxes.
Kansas. Shindler, photog., Washington, 1868.

160

KEO-KUK, Son of Keo-kuk, Jr., age 14 years.
Kansas. Shindler, photog., Washington, 1868.

161

TA-TOW-OU-DO-SA. PRAIRIE CHICKEN.
 A Pawnee Brave. Height 5 ft. 11 in.; aged 28 years.
Omaha. Copied by Shindler, Washington, 1868.

162

A Pawnee Squaw. Wife of Ta-tow-ou-dò-sa. Height 5 ft.
 7 in.; age 25 years.
Omaha. Copied by Shindler, Washington, 1868.

163

A Pawnee Squaw.
Omaha. Copied by Shindler, Washington, 1868.

164

A Pawnee Brave.
Omaha. Copied by Shindler, Washington, 1868.

165

Two Pawnee Scouts in Government service.
Omaha. Copied by Shindler, Washington, 1868.

166

Moqui Delegation to Brigham Young, 1863.

Utah.

Copied by Shindler, Washington, 1868.

167

A Montank Indian.

Copied by Shindler, Washington, 1868.

168

A Montank Indian.

Copied by Shindler, Washington, 1868.

169

Loretta Indians. The Francois Family, three generations.

Copied by Shindler, Washington, 1868.

170

Group of seven Indians presented to the Smithsonian Institution by Maj. Henry Franklin, U. S. Indian Agent, through Dr. E. Palmer.

KEECHIE INDIAN.

A-WAR-HE. A Pawnee.

BLACK BEAVER. A Delaware Chief.

LONGHORN.

AS-SA-DA-WA. Chief of the Wichitas.

KNE-WA-KA-SETS. A Keechie Chief.

POSSUM.

Copied by Shindler, Washington, 1868.

171

Camp of Arrapahoes.

Copied by Shindler, Washington, 1868.

172

KEO-KUK, Junior,

WATCHFUL FOX.

Head Chief of the Foxes.

Kansas.

Shindler, photog., Washington, 1868.

173

KEO-KUK AND HIS SON CHARLES.

Kansas. Shindler, photog., Washington, 1868.

174

KWA-KWA-OUF-PE-KWA, DEAD INDIAN.

A Fox Chief.

Kansas. Shindler, photog., Washington, 1868.

175

MAN-A-TO-WAH, MANY SCALPS.

A Fox Chief.

Kansas. Shindler, photog., Washington, 1868.

176

O-TA-DAN, PLENTY.

Minnesota. Copied by Shindler, Washington, 1868.

Taken prisoner by the military expedition under command of Brig. Gen. Sibley, 1863.

177

Sioux Dandy.

Minnesota. Copied by Shindler, Washington, 1868.

178

PA-HA-U-ZA TAN-KA, THE GREAT SCALP TAKER.

A Sioux.

Minnesota. Copied by Shindler, Washington, 1868.

The sixteen feathers in headdress indicate the number of scalps taken.

179

WA-KAN-O-THAN-THAN, MEDICINE BOTTLE.

Minnesota. Copied by Shindler, Washington, 1868.

Executed at Fort Snelling, Nov. 11, 1863, for participating in the massacre of 1862.

180**BIG-RIB.**

A Sioux Chief. The second in rank to Red Cloud.

Minnesota.

Copied by Shindler, Washington, 1868.

181**OLD BETS.**


A Sioux Squaw.

Minnesota.

Copied by Shindler, Washington, 1868.

Who will be long remembered with gratitude by many of the captives for her kindness to them while amongst the Sioux, 1862.

182

 A Drawing made by a Camanche Indian.

Copied by Shindler, Washington, 1869.

183

A Drawing made by a Camanche Indian.

Copied by Shindler, Washington, 1869.

184

A Drawing made by a Kiowa Indian.

Copied by Shindler, Washington, 1869.

185

A drawing made by a native Winnebago,

Representing the battle at White Hill between Gen. Sully and the Sioux.

Copied by Shindler, Washington, 1869.

186

KET-SAP, a Clallam Man.

SOUSCITSA, his Wife, } Chemakum Females.
WILTOH, his Sister, }

Port Townsend, W. T., 1860.

Copied by Shindler, Washington, 1869.

187

WAW-PAW-KO-LAS-KA,

BIG BEAR.

A Chief of the Sacs and Foxes.

Missouri.

Shindler, photog., Washington, 1869.

188

WO-A-PA-NA-MA, or Mo-less, **WHITE FISH.**
 Head Chief of the Sacs and Foxes.
Missouri. Shindler, photog., Washington, 1869.

189

KO-SHI-WAY, **THE SEA.**
 A Chief of the Sacs and Foxes.
Missouri. Shindler, photog., Washington, 1869.

190

SAC-A-PEE, **SHELL FISH.**
 A Chief of the Sacs and Foxes.
Missouri. Shindler, photog., Washington, 1869.

191

WO-A-PA-NA-KA-NA-KA, BEAR EATING ACORNS UP A TREE.
 (Or George Gomez, U. S. Interpreter.)
 Sacs and Fox.
Missouri. Shindler, photog., Washington, 1869.

192

A Group of three Sac and Fox Chiefs.
Missouri. Shindler, photog., Washington, 1869.

193

NA-GA-WASH, **BRITISH.**
 Head Chief of the Iowas.
Missouri. Shindler, photog., Washington, 1869.

194

MA-HE, **KNIFE.**
 An Iowa Chief.
Missouri. Shindler, photog., Washington, 1869.

195

TAR-A-KU,**DEER HAM.**

An Iowa Chief.

Missouri.

Shindler, photog., Washington, 1869.

196

TO-HU,**BRIAR.**

An Iowa Chief.

Missouri.

Shindler, photog., Washington, 1869.

197

KI-HE-KA-IN-GA,**LITTLE CHIEF.**

An Iowa Chief.

Missouri.

Shindler, photog., Washington, 1869.

198

KRA-TEN-TA-WAY,**BLACK HAWK.**

An Iowa Chief.

Missouri.

Shindler, photog., Washington, 1869.

199

PA-HATCH, or Elisha Doreau, U. S. Interpreter,**BIG BRAVE.**

An Iowa Brave.

Missouri.

Shindler, photog., Washington, 1869.

200

Group of Iowas, Agents and Interpreters.

Missouri.

Shindler, photog., Washington, 1869.

201

CHUN-EH-HOE,**MEDICINE HORSE.**

An Othoe Chief.

Nebraska.

Shindler, photog., Washington, 1869.

202

TSHE-OANG-EH-KI-HI,**BUFFALO CHIEF.**

An Othoe Chief.

Nebraska.

Shindler, photog., Washington, 1869.

203**B. BARNABI**, U. S. Indian Interpreter.

A Half Breed.

Nebraska.

Shindler, photog., Washington, 1869.

204**DA-NU-WA-IN-GA,**

LITTLE PIPE.

A Young Othoe Chief.

Nebraska.

Shindler, photog., Washington, 1869.

205**WA-IN-GA,**

PIPE STEM.

A Young Othoe Chief.

Nebraska.

Shindler, photog., Washington, 1869.

206**OC-TA-HA-SASE-HA-ZO,**

SAND.

A Creek Indian.

Arkansas River.

Shindler, photog., Washington, 1869.

207**GA-TON-ZHI,**

LITTLE TIGER.

A Creek Indian.

Arkansas River.

Shindler, photog., Washington, 1869.

208**KE-TA-SA-KA-NES**, or David Zibeo,

HOMONI.

A Miami Delegate.

Shindler, photog., Washington, 1869.

209**LUM-KI-KOM-MOA,**

THE RISING OBJECT.

A Miami Chief.

Kansas.

Shindler, photog., Washington, 1869.

210**A-TSHE-QUUG-GYA**, or J. B. Roubidoux,

TURTLE.

A Miami Chief.

Kansas.

Shindler, photog., Washington, 1869.

211

MI-TO-SAN-YA, or Thomas Miller, INDIAN.

A Miami Delegate.

Kansas. Shindler, photog., Washington, 1869.

212

A-WOA-SA-PI, or Joe Dick, RISING SUN.

A Miami Delegate.

Kansas. Shindler, photog., Washington, 1869.

213

WOA-PE-MAN-GOA, or Thomas Richardville, WHITE LOON.

A Miami Delegate.

Kansas. Shindler, photog., Washington, 1869.

214

A-SHE-SHEP-PI-SAN, or W. Quinn, LITTLE DUCK.

A Miami Delegate.

Kansas. Shindler, photog., Washington, 1869.

215

A Group of the Miami Delegation.

Kansas. Shindler, photog., Washington, 1869.

216

WA-WA-SI-SI-MO, or Graham Rodgers.

Head Chief of the Shawnees.

Kansas. Shindler, photog., Washington, 1869.

217

H. F. A. RODGERS.

Counsellor of the Shawnees.

Kansas. Shindler, photog., Washington, 1869.

218

CHARLES DUCKER.

Second Chief of the Shawnees.

Kansas. Shindler, photog., Washington, 1869.

32

219

CHE-PO-SWA, or Henry Clay,

LIGHTNING.

An Ottawa Counsellor.

Kansas.

Shindler, photog., Washington, 1869.

220

PARTEE, or John Wilson.

Chief of the Ottawas.

Kansas.

Shindler, photog., Washington, 1869.

221

SHA-PON-DA, or James Wind,

PASSING THROUGH.

Judge of the Ottawas.

Kansas.

Shindler, photog., Washington, 1869.

222

NAW-SWA-KE-SHICK, or William Hurr,

HALF-DAY.

United States Interpreter.

Kansas.

Shindler, photog., Washington, 1869.

223

B. L. LE FLORE.

Ex Governor of the Choctaw Nation.

Half-breed—Father French; Mother a Choctaw.

Kansas.

Shindler, photog., Washington, 1869.

224

PETER FOLSON.

Ex District Chief of the Choctaw Nation.

Father White; Mother a Choctaw.

Kansas.

Shindler, photog., Washington, 1869.

225

SAMUEL GARLAND.

Ex Principal Chief of the Choctaws.

Father Irish; Mother a Choctaw.

Kansas.

Shindler, photog., Washington, 1869.

226

ALLEN WRIGHT.

Present Principal Chief of the Choctaw Nation.

Kansas.

Shindler, photog., Washington, 1869.

227

J. D. JAMES.

A Chickasaw Delegate.

Kansas.

Shindler, photog., Washington, 1869.

228

WATCHFUL FOX.

KE-O-KUK,

A Sac and Fox Brave.

Kansas.

Copied by Shindler, Washington, 1869.

229**BUM-BE-SUN.**

A Sac and Fox.

Kansas.

Copied by Shindler, Washington, 1869.

230

KNIFE.

MA-HEE,

An Iowa Brave.

Missouri.

Copied by Shindler, Washington, 1869.

231

LONGHORN.

A Sac and Fox Chief.

Kansas.

Copied by Shindler, Washington, 1869.

232**NO-HE-IN-GA.**

An Iowa Chief.

Missouri.

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233

CHILDREN CHIEF.

OP-PO-NOOS,

A Sac and Fox Chief.

Kansas.

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234

NO-HE-IN-3A

An Iowa Chief.

Missouri.

Copied by Shindler, Washington, 1869.

235

NO-HE-INGA.

An Iowa Chief.

Missouri.

Copied by Shindler, Washington, 1869.

236

Sioux Indians disposing of their Dead.

Copied by Shindler, Washington, 1869.

237

An Indian looking down from a Rock.

Copied by Shindler, Washington, 1869.

238

A Sioux Indian.

Copied by Shindler, Washington, 1869.

239

WASH,

FRIDAY.

A Chief of the Arrapahoes.

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240

LITTLE BEAR.

A Chief of the Kansas Tribe.

Kansas.

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241

GOOE.

A Sioux Chief.

Missouri.

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242

RED PLUME.

A Chief of the Black Feet Indians.

Montana.

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243

HIGH TOES.

A Chief of the Cheyennes.

Colorado.

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244

BLACK ELK.

Head Chief of the Othocs.

Missouri.

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245

GREAT BEAR.

A Chief of the Delawares.

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246

A Chippewa Wedding.

Copied by Shindler, Washington, 1869.

247

HOLE IN THE DAY.

PO-GO-NE-KE-SHICK,

A Celebrated Chippewa Chief.

Minnesota.

Copied by Shindler, Washington, 1869.

Assassinated May, 1868, at Crow Wing, Minnesota, by three Beech Lake Indians.

248

STUMP.

KISH-KA-NA-KUT,

Chief of the Mille Lac Chippewas.

Minnesota.

Copied by Shindler, Washington, 1869.

249

RED BIRD.

MIS-KO-PE-NEN-SHE,

Chief of the Lake Winnipeg Band of Chippewas.

Minnesota.

Copied by Shindler, Washington, 1869.

250

AH-HA-SHA-WE-KE-SHIK,

CROSSING SKY.

Chief of the Rabbit Lake Chippewas.

Minnesota.

Copied by Shindler, Washington, 1869.

251

NAW-WE-KE-SHIK,

NOONDAY.

A Chippewa Chief.

Copied by Shindler, Washington, 1869.

252

NAH-GUN-EH-GAW-BOW,

STANDING FORWARD.

A Chief of the Rabbit Lake Chippewas.

Minnesota.

Copied by Shindler, Washington, 1869.

253

Two Shoshonee, or Snake Indians.

Utah.

Copied by Shindler, Washington, 1869.

254

CHARLEY.

A Snake Indian.

Utah.

Copied by Shindler, Washington, 1869.

255

WASH-A-KEE.

Principal Chief of the Shoshonees.

Utah.

Copied by Shindler, Washington, 1869.

256

Two Shoshonees.

Utah.

Copied by Shindler, Washington, 1869.

257

Two Shoshonees.

Utah.

Copied by Shindler, Washington, 1869.

37

258

A Sioux Chief.

Omaha.

Copied by Shindler, Washington, 1869.

259

TALL TREE.

Skull of a Tonkaway Indian.

Indian Territory.

Shindler, photog., Washington, 1869.

This was a noted medicine man, and was feared to so great an extent that the tribe accused him of being a witch, and one night a party shot him in his lodge.

260

A Skull of a Tonkaway Chief.

Indian Territory.

Shindler, photog., Washington, 1869.

Killed in battle, 1861, near old Fort Cobb. These Indians were formerly cannibals, eating their prisoners and their own dead.

261

BLACK BEAVER.

A Noted Delaware.

Copied by Shindler, Washington, 1869.

Was Captain of a company of Delawares, and served during the Mexican war; was one of Audubon's hunters; guided Gen. Marcy over the plains, during his explorations; and conducted the army out of the Indian country at the commencement of the war.

262

ASSADAWA.

Chief of the Wichitas.

Copied by Shindler, Washington, 1869.

263

Indian Drawing, with Explanation.

Copied by Shindler, Washington, 1869.

264

A Family of Snake Indians.

Utah.

Copied by Shindler, Washington, 1869.

265

VENUS AND ADONIS.

Shoshonees.

Utah.

Copied by Shindler, Washington, 1869.

266

SNAKE INDIANS ON HORSEBACK.

Utah.

Copied by Shindler, Washington, 1869.

267

A Group of Snake Indians.

Utah.

Copied by Shindler, Washington, 1869.

268

TWO SHOSHONEE CHIEFS.

Utah.

Copied by Shindler, Washington, 1869.

269

A Group of four Shoshonees.

Man, half breed ; mother, white ; father, Shoshonee.

Utah.

Copied by Shindler, Washington, 1869.

270

A Group of Ute Indians.

Utah.

Copied by Shindler, Washington, 1869.

271

A Group of Utes on horseback.

Utah.

Copied by Shindler, Washington, 1869.

272

FOUR UTE SQUAWS.

Utah.

Copied by Shindler, Washington, 1869.

273

Three Graces of the Gosh-Ute Tribe.

Utah.

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274

A Group of three Pah-Utes.

Utah.

Copied by Shindler, Washington, 1869.

275

Little Soldier and his Squaw; Pah-Utes.

Utah.

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276

LITTLE SOLDIER.

A Pah-Ute.

Utah.

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277

Little Soldier's Squaw.

Utah.

Copied by Shindler, Washington, 1869.

278

A Group of Bannak Indians.

Utah.

Copied by Shindler, Washington, 1869.

279

A Bannak Brave.

Utah.

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280**KANOSH.**

Chief of the Parawan Indians.

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281

A Parowan Chief.

Utah.

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282

ANNIE STIDHAM, Daughter of G. Stidham.

A Creek. Aged 18 years.

Kansas.

Shindler, photog., Washington, 1869.

283

GEORGE STIDHAM, Son of G. W. Stidham.

Delegate of the Creek Nation.

Born March 17, 1859. Mother white.

Kansas.

Shindler, photog., Washington, 1869.

284

SHA-VA-NOH.

A War Chief of the Tabaguache Tribe of Utes.

Colorado.

Copied by Shindler, Washington, 1869.

285

SHA-VA-NOH.

A War Chief of the Tabaguache Tribe of Utes.

Colorado.

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286

WOLF.

A Ute Warrior.

Colorado.

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287

AN-THRO.

Chief of the United Band of Utes.

Colorado.

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288

CHU.

A Ute Brave.

Colorado.

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289**SAP-PIX AND SON.**

Ute Warriors.

Colorado.

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290**LA-GA-CHA-WICH.**

A Ute Chief.

Colorado.

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291

RAINBOW.

A Ute Chief.

Colorado.

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292

A Group of three Pah-Utes.

Utah.

Copied by Shindler, Washington, 1869.

293

A Group of four Pah-Utes.

Utah.

Copied by Shindler, Washington, 1869.

294

A Group of three Pah-Utes.

Utah.

Copied by Shindler, Washington, 1869.

295

A Group of two Pah-Utes.

Copied by Shindler, Washington, 1869.

296

A Pah-Ute Chief.

Utah.

Copied by Shindler, Washington, 1869.

297

A Group of three Pah-Utes.

Utah.

Copied by Shindler, Washington, 1869.

298

A Pah-Ute Chief.

Utah.

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299

A Pah-Ute Chief.

Utah.

Copied by Shindler, Washington, 1869.

300

TSHE-TON-WA-KU-WA-MA-NI, THE HAWK THAT HUNTS
WALKING. Also called LITTLE CROW.

A Chief of the Mdewakanton Sioux, and Leader of the
Massacre in Minnesota, 1862. Killed.

Copied by Shindler, Washington, 1869.

301

WO-WI-NA-PE,

ONE WHO COMES IN SIGHT.

Little Crow's Son.

Minnesota.

Copied by Shindler, Washington, 1869.

Taken prisoner by the military expedition under command of Brig.-Gen.
Sibley, 1863.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

301

LIST

OF

PUBLICATIONS

OF THE

SMITHSONIAN INSTITUTION,

JULY, 1877.



WASHINGTON, D. C.:

JULY, 1877.



ADVERTISEMENT.

THE present catalogue is intended to embrace all the articles published by the Smithsonian Institution since its organization in 1846 to the first of July, 1877, a period of more than thirty years. For the first few years nothing was issued but pamphlets explanatory of the plan of the Institution, and brief annual reports of the proceedings of the Regents, and it was not until after 1849 that the following regular series were established, viz:—

1st. A quarto series entitled "Smithsonian Contributions to Knowledge," issued in volumes, each generally embracing several articles.

2d. An octavo series, entitled "Smithsonian Miscellaneous Collections," also issued in volumes, each embracing one or more separate articles.

3d. Another octavo series, consisting of the Annual Reports of the Institution to Congress, called "Smithsonian Reports," and printed at the expense of the government.

The Smithsonian Contributions to Knowledge include memoirs embracing the records of extended original investigations and researches resulting in what are believed to be new truths, and constituting positive additions to the sum of human knowledge, to the production of which the Institution has in some way rendered assistance.

The series of Smithsonian Miscellaneous Collections is designed to contain reports on the present state of our knowledge of particular branches of science; instructions for collecting and digesting facts and materials for research; lists and synopses of species of the organic and inorganic world; museum catalogues; reports of explorations; aids to bibliographical investigations, etc., generally prepared at the express request of the Institution, and at its expense. The position of a work in one or the other of these two series will sometimes depend upon whether the required illustra-

tions can be presented more conveniently in the quarto or the octavo form.

The Annual Reports are presented to Congress, and printed at its expense, copies being given to the Institution for distribution. They consist of the reports of the Secretary to the Board of Regents of the operations and condition of the Institution; the reports of committees of the Board; reports of lectures; extracts from correspondence; original or translated articles relating to the history and progress of science, etc. Over the typography and general mechanical execution, as well as the number of copies of the Smithsonian Annual Reports, the Institution has no control.

In the first experiments of the Smithsonian system of publication, the proper magnitude of the editions necessary to meet the immediate and future demand could not be accurately ascertained. The number of copies of the Contributions then fixed upon, has since been found inadequate, although it was larger than that usually issued by other institutions. The edition has, therefore, been augmented, until at the present time 1000 copies of each article are set aside to be combined into volumes, and an extra number, varying with the probable demand, from 500 to 1500, struck off for separate distribution, and for sale.

Each article is complete in itself, with separate paging, title, and index, and without any necessary relationship to others combined with it in the same volume.

Of the first volumes of Smithsonian Contributions, the edition, for reasons already explained, was less than of the succeeding ones, so that complete sets cannot now be furnished. A considerable number of the earlier articles in octavo were out of print before the commencement of the series of "Miscellaneous Collections," and consequently are not included in them.

The regular series of volumes of Smithsonian Annual Reports begins with that for 1853, those for previous years being pamphlets now out of print. The essential portion of their contents is, however, given in the volume for 1853, so as to present a complete summary of the history of the operations of the Institution from its commencement.

The rules governing the distribution of the Smithsonian publications are appended. To enable institutions not coming within their provisos, as well as individuals, to procure copies of such as may be desired, a small number is set aside, and sold by the Institution, or its agents, at the prices affixed, which are intended merely to cover the actual cost of their publication. They may be obtained

RULES FOR DISTRIBUTION.

v

either directly from the Institution or of its agents, Dodd, Mead, & Co., New York; B. Westermann & Co., New York; American Naturalist Agency, Salem, Mass.; Wm. Wesley, 28 Essex Street, Strand, London.

Works not priced in the following list are to be considered as out of print, and not to be supplied.

JOSEPH HENRY,
Secretary S. I.

SMITHSONIAN INSTITUTION,
WASHINGTON, July, 1877.

RULES FOR DISTRIBUTION.

TO INSTITUTIONS.

The publications of the Smithsonian Institution are furnished:—

1st. To Learned Societies of the first class, which present complete series of their publications to the Institution.

2d. To Libraries of the first class, which give in exchange their catalogues and other publications; or an equivalent, from their duplicate volumes.

3d. To Colleges of the first class, which furnish catalogues of their libraries and of their students, and all other publications relative to their organization and history.

4th. To Public Libraries containing 15,000 volumes.

5th. To Public Libraries containing less than 15,000 volumes, where a large district would be otherwise unsupplied.

6th. Institutions devoted exclusively to the promotion of particular branches of knowledge may receive such Smithsonian publications as relate to their respective objects.

TO INDIVIDUALS.

The distribution to *individuals*, of the publications of the Institution, is restricted:—

1st. To those who are engaged in original research in the branch of science to which the book asked for pertains, or to whom it is necessary in the business of instruction.

2d. To donors to the Museum or Library of the Institution.



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OF
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To July, 1877.

Where no price is affixed the work cannot be furnished, it being out of print or not yet published.

Publications marked * do not appear in the Contributions, Collections, or Reports.

No.	AUTHOR.	TITLE.		PAGES.	DATE.	PRICE.
A	.....	Journal of Regents,	8vo.*	32	1846	
B	.....	Report of Organisation Committee	8vo.*	32	1847	
C	.....	Digest of Act of Congress,	8vo.*	8	1847	
D	Dallas, G. M.	Address at Laying Corner Stone,	8vo.*	8	1847	
E	Henry, Jos.	Exposition of Bequest,	8vo.*	8	1847	
F	.....	First Report of Secretary,	8vo.*	48	1848	
G	.....	Report of the Institution,	8vo.*	38	1847	
H	.....	Second Report of Institution,	8vo.*	208	1848	
I	.....	Third Report of Institution,	8vo.*	64	1849	
J	.....	Programme of Organization,	4to.*	4	1847	
K	.....	Correspondence, Squier & Davis,	8vo.*	8	1848	
L	.....	First Report of Organization Com- mittee,	8vo.*	8	1846	
M	.....	Reports of Institution up to Jan. 1849,	8vo.*	72	1849	
N	.....	Officers, Regents, Act, &c.,	8vo.*	14	1846	
O	.....	Act to establish Smithsonian In- stitution,	8vo.*	8	1846	
P	Owen, E. D.	Hints on Public Architecture,	4to.*	140	1849	
Q	.....	Check List of Periodicals,	4to.*	28	1853	
1	Squier & Davis,	Ancient Monuments of Missis- sippi Valley,	S. C. 1,	346	1847	
2	.....	Smithsonian Contributions to Knowledge	S. C. 1,	346	1848	

No.	AUTHOR.	TITLE.		PAGES.	DATE.	PRICE.
3	Walker, S. C.	Researches, Planet Neptune	S. C. II,	60	1850	
4	Walker, S. C.	Ephemeris of Neptune for 1848,	S. C. II,	8	1849	
5	Walker, S. C.	Ephemeris of Neptune for 1849,	S. C. II,	32	1849	
6	Walker, S. C.	Ephemeris of Neptune for 1850,	S. C. II,	10	1850	
7	Walker, S. C.	Ephemeris of Neptune for 1851,	S. C. II,	10	1850	
8	Downes, John	Occultations in 1848,	4to.*	12	1848	
9	Downes, John	Occultations in 1849,	4to.*	24	1848	
10	Downes, John	Occultations in 1850,	4to.*	26	1849	
11	Downes, John	Occultations in 1851,	S. C. II,	26	1850	
12	Lieber, Francis	Vocal Sounds of L. Bridgeman,	S. C. II,	32	1850	
13	Ellet, Charles	Physical Geography of U. S.	S. C. II,	64	1850	
14	Gibbes, R. W.	Memoir on Mosasaurus,	S. C. II,	14	1850	
15	Squier, E. G.	Aboriginal Monuments of N. Y.	S. C. II,	188	1850	
16	Agassiz, Louis	Classification of Insects,	S. C. II,	28	1850	
17	Hare, Robert	Explosiveness of Nitre,	S. C. II,	20	1850	
18	Gould, Jr., B. A.	Discovery of Neptune,	8vo.*	56	1850	
19	Guyot, A.	Directions for Meteorological Observations,	8vo.*	40	1850	
20	Bailey, J. W.	Microscopic Examination of Soundings,	S. C. II,	16	1851	
21	.....	Annual Report of Smithsonian Institution for 1849	8vo.	272	1850	
22	Gray, Asa	Plantæ Wrightianæ,	S. C. III,	146	1852	
23	Bailey, J. W.	Microscopic Observations in S. Carolina, Georgia, and Florida,	S. C. II,	48	1851	
24	Walker, S. C.	Ephemeris of Neptune, 1852. Appendix I,	S. C. III,	10	1853	
25	Jewett, Chas. C.	Public Libraries of United States,	8vo.*	210	1851	.50
26	.....	Smithsonian Contributions to Knowledge,	S. C. II,	464	1851	
27	Booth, J. C. and Morfit, C.	Improvements in Chemical Arts,	M. C. II,	216	1852	.50
28	.....	Annual Report of Smithsonian Institution for 1850,	8vo.	326	1851	
29	Downes, John	Occultations in 1852,	S. C. III,	34	1851	

No.	AUTHOR.	TITLE.		PAGES.	DATE.	PRICE.
30	Girard, Charles	Fresh-Water Fishes of N. America	S. C. III,	80	1851	
31	Guyot, A.	Meteorological Tables,	M. C. I,	212	1852	
32	Harvey, Wm. H.	Marine Algæ of North America. Part I,	S. C. III,	152	1852	
33	Davis, Chas. H.	Law of Deposit of Flood Tide,	S. C. III,	14	1852	.75
34	.....	Directions for Collecting Specimens,	M. C. II,	40	1850	free
35	Locke, John	Observations on Terrestrial Magnetism,	S. C. III,	3	1852	
36	Secchi, A.	Researches on Electrical Rheometry,	S. C. III,	60	1852	
37	Whittlesey, Ch.	Ancient Works in Ohio,	S. C. III,	20	1851	
38	.....	Smithsonian Contributions to Knowledge,	S. C. III,	564	1852	
39	.....	Smithsonian Contributions to Knowledge,	S. C. IV,	426	1852	
40	Riggs, S. R.	Dakota Grammar and Dictionary,	S. C. IV,	414	1852	
41	Leidy, Joseph	Extinct American Ox,	S. C. V,	20	1852	
42	Gray, Asa	Plantæ Wrightianæ. Part II,	S. C. V,	120	1853	
43	Harvey, Wm. H.	Marine Algæ of North America. Part II,	S. C. V,	262	1853	10.00
44	Leidy, Joseph	Flora and Fauna within Living Animals,	S. C. V,	68	1853	
45	Wyman, Jeffries	Anatomy of Rana Pipiens,	S. C. V,	52	1853	
46	Torrey, John	Plantæ Fremontianæ,	S. C. VI,	24	1853	
47	Jewett, Chas. C.	Construction of Catalogues of Libraries,	8vo.*	108	1853	.50
48	Girard, Charles	Bibliotheca Americana Historico Naturalis,	8vo.*	68	1852	
49	Baird, S. F. and Girard C.	Catalogue of Serpents,	M. C. II,	188	1853	1.00
50	Stimpson, Wm.	Marine Invertebrata of Gr. Manan	S. C. VI,	68	1853	1.50
51	.....	Annual Report of Smithsonian Institution for 1851,	8vo.	104	1852	
52	Coffin, Jas. H.	Winds of the Northern Hemisphere,	S. C. VI,	200	1853	
53	Stanley, J. M.	Portraits of N. American Indians,	M. C. II,	76	1852	
54	Downes, John	Osculations in 1853,	S. C. VI,	36	1853	

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55	Smithsonian Contributions to Knowledge,	S. C. v,	538	1853	
56	Smithsonian Contributions to Knowledge,	S. C. vi,	476	1854	
57	.....	Annual Report of Smithsonian Institution for 1852,	8vo.	96	1853	
58	Leidy, Joseph	Ancient Fauna of Nebraska,	S. C. vi,	126	1853	
59	Chappelsmith, J.	Tornado in Indiana,	S. C. vii,	12	1855	.25
60	Torrey, John	Batis Maritima,	S. C. vi,	8	1853	
61	Torrey, John	Darlingtonia Californica,	S. C. vi,	8	1853	
62	Melsheimer, F.E.	Catalogue of Coleoptera,	8vo.*	190	1853	2.00
63	Bailey, J. W.	New Species of Microscopic Organisms,	S. C. vii,	16	1854	.50
64	.....	List of Foreign Correspondents of Smithsonian Institution,	M. C.	16	1856	
65	.....	Registry of Period. Phenomena,	folio,*	4	1854	
66	.....	Annular Eclipse, May 26, 1854	M. C.	14	1854	
67	.....	Annual Report of Smithsonian Institution for 1853,	8vo.	310	1854	
68	Mitchell, B. E. & Turner, W. W.	Vocabulary of Jargon of Oregon,	8vo.*	22	1853	
69	.....	List of American Correspondents of Smithsonian Institution,	8vo.*	16	1853	
70	Lapham, I. A.	Antiquities of Wisconsin,	S. C. vii,	108	1855	
71	Haven, S. F.	Archæology of the United States,	S. C. viii,	172	1856	
72	Leidy, Joseph	Extinct Sloth Tribe of N. America,	S. C. vii,	70	1855	
73	.....	Publications of Societies in Smithsonian Library,	S. C. vii,	40	1855	.25
74	.....	Catalogue of Smithsonian Publications,	M. C. v,	52	1862	
75	.....	Annual Report of Smithsonian Institution for 1854,	8vo.	464	1855	
76	.....	Smithsonian Contributions to Knowledge,	S. C. vii,	252	1855	
77	Annual Report of Smithsonian Institution for 1855,	8vo.	440	1856	
78	Smithsonian Contributions to Knowledge,	S. C. viii,	556	1856	

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79	Runkle, John D.	Tables for Planetary Motion,	S. C. ix,	64	1856	1.00
80	Alvord, Benj.	Tangencies of Circles and Spheres,	S. C. viii,	16	1856	1 00
81	Olmsted, D.	Secular Period of Aurora Borealis	S. C. viii,	52	1856	
82	Jones, Joseph	Investigation on A. Vertebrata,	S. C. viii,	150	1856	1.50
83	Meech, L. W.	Relative Intensity of Heat and Light of the Sun,	S. C. ix,	58	1856	1.25
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86	Mayer, Brants	Mexican History and Archaeology	S. C. ix,	36	1856	
87	Coffin, Jas. H.	Psychrometrical Tables,	M. C. i,	20	1856	.25
88	Gibbs, W. and Genth, F. A.	Ammonia Cobalt Bases,	S. C. ix,	72	1856	1.00
89	Brewer, Th. M.	North American Oology. Part I,	S. C. xi,	140	1857	5.00
90	Hitchcock, E.	Illustrations of Surface Geology,	S. C. ix,	164	1857	4.00
91	.....	Annual Report of Smithsonian Institution for 1856,	8vo.	468	1857	
92	.....	Smithsonian Contributions to Knowledge,	S. C. ix,	482	1857	
93	.....	Meteorological Observations for 1855,	8vo.*	118	1857	
94	Runkle, John D.	Asteroid Supplement to New Tables for $b \frac{(i)}{s}$,	S. C. ix,	72	1857	1.00
95	Harvey, Wm. H.	Marine Algæ of North America. Part III,	S. C. x,	142	1858	6.00
96	Harvey, Wm. H.	Marine Algæ of North America 3 parts complete,	4to.	568	1858	20.00
97	Kane, E. K.	Magnetic Observations in the Arctic Seas,	S. C. x,	72	1859	1.00
98	Bowen, T. J.	Yoruba Grammar and Dictionary.	S. C. x,	232	1858	4.00
99	.....	Smithsonian Contributions to Knowledge,	S. C. x,	462	1858	12.00
100	Gillis, J. M.	Eclipse of the Sun, Sept. 7, 1858,	S. C. xi,	22	1859	.50
101	Hill Thos.	Map of Solar Eclipse, Mar. 15, '58,	8vo.*	8	1858	.15
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ANNUAL REPORTS OF THE SMITHSONIAN INSTITUTION.

THE Annual Report of the Institution consists of the Reports of the Secretary, of the Executive and Building Committees, Proceedings of the Board of Regents, Lists of Meteorological Observers and Donors to the Museum, Statistics of Exchanges, Publications, etc. etc., and a General Appendix.

The object of the General Appendix is to illustrate the operations of the Institution by reports of lectures and extracts from correspondence, as well as to furnish information of a character suited especially to meteorological observers and other persons interested in the promotion of knowledge.

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INDEX CATALOGUE

OF

BOOKS AND MEMOIRS

RELATING TO

NEBULÆ AND CLUSTERS, ETC.,

BY

EDWARD S. HOLDEN.



WASHINGTON:
SMITHSONIAN INSTITUTION.

1877.



**"For out of the olde feldis, as men saletþ,
Comith all this newe corne, fro yere to yere,
And out of oldè bokis, in gode faletþ,
Comith all this newe Science, that men lere."**

The Assemble of Foules.—CHAUCER.



ADVERTISEMENT.

Whoever attempts the enlargement of the bounds of knowledge in any particular branch of science, in justice to himself, the public, and previous laborers in the same field, should make himself familiar with all that has been previously published on the subject. But, information of this kind is so widely dispersed through the journals and transactions of learned societies of all parts of the civilized world, that index catalogues or references to authorities are of the utmost importance to the investigator. In consideration of this fact, the present work has been accepted for publication, after having received the approval of our collaborators in the line of astronomy.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, *November*, 1877.

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INTRODUCTION.

The design of the following Catalogue is to give a full list of books and memoirs relating to Nebulæ and Clusters, and to include references to papers on allied subjects—as the Milky Way, the Nebular Hypothesis, etc., etc., which may serve to give as complete a knowledge as possible of the first two subjects. It was undertaken in 1874, for my own use, and has been steadily prosecuted until the present time; and I am induced to offer it for publication, by the hope that it may be found as useful to others as it has already been to myself. It is believed to be nearly complete, so far as the uses of the astronomer require. It is impossible, in a work of this kind, to insure its entire completeness, but it is hoped that few important papers are omitted. It is also beyond the limits of the plan to make an index for the bibliographer chiefly.

In reading upon any special subject there are several cases which may arise: *First*, having any given series of publications, as the *Philosophical Transactions*, for example, one may wish to know all that has been printed in that series on this particular subject. The present index has under the title of each publication a reference to all works on nebulæ and clusters contained in it. *Second*, one may wish to know all the works on the special subject which we owe to a particular author no matter where published; in the present index, under each author's name, is given a list of his writings on nebulæ, etc., arranged not chronologically, as in a work of more extended scope they should be, but by periodicals. All the papers of D'ARREST, for example, in the *Astronomische Nachrichten*, are to be found together, chronologically arranged, and so with papers in other journals. This form is convenient for an index of so special a nature as the one in question, par-

ticularly as difficulties frequently arise as to the date of a paper, which it is often hard to fix except by some arbitrary rule. If such a rule be once adopted it must be adhered to although it will often disarrange the true logical order of the papers. *Third*, the question may be to discover all the papers written on a special subject, no matter by what author. In the present case such a question might be to find the papers which have been written on a given nebula, or on the spectra of nebulae in general, or something allied to this. It is plain that in so new a subject great subdivision is not required, and I find by experience that all my own wants in this direction have been supplied by adding after the reference to each paper a note more or less extended, giving an indication of the purport of the paper. A slight familiarity with the writings of the various authorities will enable one readily to turn to the authors likely to have treated a given subject. Thus if the proper motion of nebulae was in question, the writings of OTTO STRUVE, D'ARREST, SCHOENFELD, VOGEL, SCHULTZ, SCHMIDT, RÜMKER, ARGELANDER, OPPOLZER, WINNECKE, etc., would naturally be first consulted, and so with other subjects.

One nebula, that in *Orion*, has received a vast amount of study, and I have added a special bibliography of this, as well as one referring to the Variable Nebulae.

Section IV consists of a reference-list to all published (and many unpublished) drawings of nebulae and clusters. Under this head many of the most extended memoirs will be again indexed, and nearly all the monographs, so that it supplements in a way the main index. That is if the memoirs on a certain nebula are sought for and no preliminary clue is at hand, (as to authors,) it will be well before looking through the whole list of author's names, to look for this nebula in the list of drawings. If it is found there, the references joined to it will indicate the principal papers on this object.

To facilitate the finding of nebulae I have given in this part of

the work a finding list of Sir WILLIAM HERSCHEL's classes and numbers, as well as of MESSIER's nebulæ—the identifications resting on the authority of Sir J. HERSCHEL.

The abstracts of Sir WILLIAM HERSCHEL's papers I have made much more full than in other cases, in order to present, if possible, something like an adequate idea of the views of this great man on the subject which is peculiarly his own. This is the more necessary, as we have as yet no collection of his works which is generally available, (a want which it is hoped may be filled,) and as the earlier volumes of the *Philosophical Transactions* are now quite rare.*

References to translations and reprints of important papers have frequently been included in order that such papers may be accessible to as many as possible in the native language of the reader.

Many popular and historical papers have been referred to which appeared in Reviews and Magazines, but it is not supposed that such references are by any means exhaustive of this part of the subject, nor does it seem desirable that they should be so, since they are largely repetitions one of another.

I have included (with some hesitation) a few references to the views of the ancients on the Milky Way, etc., which may be thought to render the Index more complete by presenting more fully the historical side of the subject; but in the main it refers to publications made between the epoch of the invention of the telescope and the present time.

It is to be noted that the references here made are always from a consultation of the original work, when this was accessible, and not by a transcription from any indices or general catalogues, like the Royal Society's *Catalogue of Scientific Papers* for example. These

* A complete collection of his separate papers exists at the Pulkowa Observatory, and also one in five volumes in the possession of his descendants in England, but in order to gain an acquaintance with them in general, it is necessary to examine no less than thirty-nine separate volumes of the *Philosophical Transactions*. Much unpublished and most precious material exists in manuscript.

have however been consulted in order to secure the necessary checks upon accuracy.

A considerable number of the works quoted are not to be obtained in the United States, and in many cases I have had only incomplete sets of periodicals at hand, which may explain possible omissions.

Following, I give a list of all works on special astronomical bibliography which are known to me, which may be of use to those consulting this Catalogue.

Among this list of works, the only one similar in purport to the present, is the work of my friend E. B. KNOBEL, Esq., F. R. A. S., etc. A careful comparison with § 4 of his work has assured me of the accuracy both of his list and of the present one as it stood in manuscript at the time of the publication of Mr. KNOBEL's paper.

The present Index is somewhat wider in scope than § 4 of Mr. KNOBEL's, and it contains a special reference to the contents of each paper, which is not given in the other list. As the two works were done independently, each serves as a useful check upon the other.

LIST OF ASTRONOMICAL BIBLIOGRAPHIES.

BELGIAN ACADEMY OF SCIENCES: *Bibliographie Académique*. 1875. 8vo.

[This work contains, beside brief biographies of the various members of the Academy, a full list of those works of each member which have been printed in the publications of this Academy, as well as tolerably full lists of such works printed elsewhere.]

CARL, PH.: *Principien der Astronomischen Instrumentenkunde*, p. 161.

[Literature of Micrometers.]

———: *Repertorium der Cometen-Astronomie*. 8vo. 1864.

[Contains references to observations, etc., of comets, and is very complete.]

DARBOUX and HOUËL: *Bulletin des Sciences Mathématiques et Astronomiques*. Periodical. 8vo.

[Contains abstracts of, and criticisms upon, works and memoirs on Astronomy, Mathematics, etc.]

ENGELMANN, R.: *Literatur der Astronomische Nachrichten, etc.*, from BESSEL's *Abhandlungen*. 8 vols., 4°. 1876-7.

[There are now three volumes, 4°, of Indices to the *Astronomische Nachrichten*, which are very full, arranged both by authors and subjects, and issued periodically by the editors.] ENGELMANN's *Indices*, as below, are even more full for the special subjects treated.

Vol.	Page.	Subject.
I	83	[Comets.]
I	194	[Saturn and Saturn's Satellites.]
I	260	[Refraction.]
I	316	[Aberration, Nutation, and Precession.]
II	202	[Instruments.]
II	236	[Parallax of Stars.]
II	281	[Fundamental Stars, Star Catalogues, and Star Charts.]
II	325	[Proper Motion, Variable Proper Motion, Double Stars.]
II	404	[Mathematics.]
III	138	[Geodesy, Longitudes, Measurement of an Arc of Meridian.]
III	286	[Pendulums; Units of Mass, etc.; Terrestrial Refraction, etc.]
III	489	[Miscellaneous.]

KNOBEL, E. B.: *Reference Catalogue of Astronomical Papers and Researches*. 8vo. 1876. *Mon. Not. R. A. S.*, November.

LALANDE, J.: *Bibliographie Astronomique, etc.* 1803. See *C. T.*, 1806.

LONDON, ROYAL SOCIETY OF: *Catalogue of Scientific Papers*. [1800-1863.] 6 vols., 4°. 1867-1872.

POGGENDORF: *Bibliographisch-Literarisches Handwörterbuch zur Geschichte der Exacten Wissenschaften, etc.* 2 vols., 8vo. 1863.

REUSS, J. D.: *Repertorium Commentationum, etc.* Vol. V. *Astronomia*. 1804. 4°.

SCHEIBEL, J. E.: *Astronomische Bibliographie*. 1st part, 1784; 2d part, 1786; 3d part, with Appendices to parts 1 and 2, 1789-1798. 8vo.

SCHUMACHER, H. C.: *Catalogue des Livres Composant la Bibliothèque de feu H. C. SCHUMACHER*. Part I. [Mathematics, Astronomy, etc.] 1855. 8vo. pp. 147. [Other valuable works of this class are frequently printed by various publishers.]

SOHNCKE, L. A.: *Bibliotheca Mathematica*. Verzeichniss der Bücher über Astronomie, etc., welche in Deutschland und dem Auslande vom Jahre 1830 bis 1854, erschienen sind. 1854. 8vo.

ST. PETERSBURG ACADEMY OF SCIENCES: *Tableau général Méthodique et Alphabétique des Matières contenues dans les Publications de l'Académie Impériale des Sciences de St. Petersbourg depuis sa fondation*. 1ère partie. *Langues étrangères*. 8vo. 1874.

STRUVE, OTTO V.: *Catalogus Librorum in Bibliotheca Speculæ Pulcovensis.* 8vo. 1858.

WEIDLER, J. F.: *Bibliographia Astronomica, etc.* 1755. 8vo.

WELLER: *Cometen-Literatur in the Anzeiger für Kunde der Deutschen Vorzeit.* 1857. No. 10, p. 321; No. 11, p. 359.

WOLF, R.: *Sonnenflecken Literatur in the Astronomische Mittheilungen.*

——: *Handbuch der Mathematik, Astronomie, etc.* 2 vols., 8vo. 1872.

YOUNG, THOS.: *A Course of Lectures on Natural Philosophy.* 2 vols. 1807. 4°. Vol. ii, p. 87.

PRINCIPAL ABBREVIATIONS USED IN THE REFERENCES OF THE
PRESENT WORK.*

Abbreviation.	Work referred to.
<i>Am. Ass. Adv. Sci.</i>	Proceedings American Association for the Advancement of Science.
<i>Am. Jour. Sci.</i>	Silliman's American Journal Science and Arts.
<i>A. N.</i>	Astronomische Nachrichten.
<i>Ast. Jour.</i>	Gould's Astronomical Journal.
<i>B. A. A. S.</i>	Reports British Association for the Advancement of Science.
<i>Bern.</i>	Mitt. d. Naturforsch. Gesell. in Bern.
<i>B. J.</i>	Bode's [or Berliner] Jahrbuch.
<i>C. R.</i>	Comptes Rendus de l'Académie Royale des Sciences.
<i>C. T.</i>	Connaissance des Temps.
<i>Mem. A. A. S.</i>	Memoirs American Academy of Arts and Sciences. [Boston.]
<i>Mem. R. A. S.</i>	Memoirs of the Royal Astronomical Society.
<i>Mem. Soc. Spet. Ital.</i>	Memorie della Società degli Spettroscopisti Italiani.
<i>Mon. Not. R. A. S.</i>	Monthly Notices of the Royal Astronomical Society.
<i>M. M.</i>	Mélanges Mathématiques et Astronomiques.
<i>Paris.</i>	Histoire [ou Mémoires] de l'Académie Royale des Sciences.
<i>Phil. Mag.</i>	London, Edinburgh and Dublin Philosophical Magazine.
<i>Proc. A. A. S.</i>	Proceedings American Academy of Arts and Sciences. [Boston.]
<i>Proc. R. S.</i>	Proceedings of the Royal Society of London.
<i>P. T.</i>	Philosophical Transactions of the Royal Society of London.
<i>p. t.</i>	Philosophical Transactions of the Royal Society of London—abridgment to 1800, by HUTTON.
<i>Quar. Jour. Sci.</i>	Quarterly Journal of Science.
<i>Sid. Mess.</i>	Mitchel's Siderial Messenger.
<i>V. J. S.</i>	Vierteljahrsschrift der Astron. Gesell. [Leipzig.]

* Those used and not given here will be easily understood.

It remains to state that in the main body of the Catalogue I have catalogued names commencing with LE or LA under L, as LALANDE, LAHIRE, etc. Names commencing with DE have not been placed under D, with the exception of D'ARREST, D'ABBADIE, etc. Names commencing with VON are not catalogued under V.

EDWARD S. HOLDEN.

U. S. NAVAL OBSERVATORY,

WASHINGTON, *January*, 1877.



I.

INDEX-CATALOGUE OF BOOKS AND MEMOIRS RELATING TO NEBULÆ, CLUSTERS, ETC.

[Alphabetically arranged by authors.]

Abbe: [Distribution of Nebulæ in space.] *Mon. Not. R. A. S.*, xxvii, p. 257.

——: *Mon. Not. R. A. S.*, xxxv, p. 236, and *Am. Ass. Adv. Sci.*, 1870, p. 40. [The very much extended nebulæ of **HERSCHEL**'s Catalogue.] See also *Am. Jour. Sci.*, 3d series, ix, p. 42.

——: **JOHNSON**'s *Cyclopedia*, 4°, 1876, article *Nebula*, [succinct history.]

Abbott: *Mon. Not. R. A. S.*, xxiii, p. 32. [Cluster κ *Crucis*.]

——: [Nebula surrounding η *Argûs*.] *Mon. Not. R. A. S.*, xxv, 192; xxviii, 200.

——: *Mon. Not. R. A. S.*, xxxi, pp. 226, 230, 231. [Nebula in *Argo*.]

——: *Mon. Not. R. A. S.*, xxxii, p. 61. [Note on Nebula in *Argo*.]

——: [Nebula surrounding η *Argûs*.] *Mon. Not. R. S. Tasmania*, 1870, p. 21, [2 sketches]; 1871, p. 17; 1872, p. 27.

Abhandlung d. König. Sächs. Gesellschaft der Wissenschaften: See *Sächs. Gesell. König. Abh.*

Academy of Sciences, Paris: *Histoire et Mémoires*.

<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>	<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>
Vol X. }	117	{ La Hire.	1759	469	[Cheseux.]
1666-9 }		{ Cassini.	1759	453	Legentil.
1707	854	Maraldi.	1771	435	Messier.
1733	19	Fontaney.	1777	440	Messier.
1734	78	Maupertius.	1779	505	Jaurat.
1746	55	Maraldi.	1789	610	Le Monnier.
1755	194	Lacaille.	1807	206	Messier.

Academy of Sciences, Paris: *Comptes Rendus*.

<i>Volume.</i>	<i>Page.</i>	<i>Author.</i>	<i>Volume.</i>	<i>Page.</i>	<i>Author.</i>
XIII	449	De Vico.	LV	888	Chacornac.
"	450	Arago.	LVI	637	Chacornac.
XVII	190	De Vico.	LVIII	72	Goldschmidt.
XXIV	1021	Laugier.	LX	468	Faye.
XXVI	50	Arago.	"	543	Secchi.
XXVII	112-188	Butillon.	LXV	63	Secchi.
XXVIII	573	Laugier.	LXVI	806	[Chacornac.]
XXX	358	Hind.	"	643	Secchi.
XXXVII	874	Laugier.	LXIX	1519	{ Frankland.
XL	775	Dien.			{ Lockyer.
XLIV	1031	Porro.	LXXIII	825	Stephan.
"	1074	Le Verrier.	LXXIV	444	Stephan.
"	1075-1294	De Senarmont.	LXXVI	1073	Stephan.
"	1293-1295	Le Verrier.	LXXVII	1364	Stephan.
"	1279	Secchi.	LXXVIII	313	Stephan.
XLV	170	Secchi.	LXXXI	29	Wolf, C.
LIV	293	Le Verrier.	"	749	Planté.
"	1012	Le Verrier.	"	891	Tisserand.
LV	606	{ Le Verrier.	LXXXIII	828	Stephan.
"	751	{ Lassell.	LXXXIV	641	Stephan.
LV	792	{ Secchi.	"	705	Stephan.
		{ Schönfeld			

Account of Several Nebulæ, etc.: [HALLEY,] *P. T.*, xxix, p. 390.

Adams, J. C.: Address on presenting the gold medal of the R. A. S. to D'ARREST, February, 1875. *Mon. Not. R. A. S.*, xxxv, p. 265.

Airy: *Mon. Not.*, iii, p. 167. [The History and present state of our knowledge of Nebulæ.]

——: *Mon. Not. R. A. S.*, xxxi, p. 233. [Nebula in *Argo*.]

——: *Mem. R. A. S.*, ix, p. 303. [Address on delivering gold medal to Sir J. HERSCHEL.]

Alexander, S.: On the origin of the forms, etc., of Nebulæ. *Ast. Jour.*, Vol. II., p. 95, Nos. 36-44.

——: *Am. Jour. Sci.*, 2d series, xv, p. 300.

Alphonso X.: *Libros del Saber de Astronomia*. Vol I, p. 143, 4°.

American Academy of Arts and Sciences: *Memoirs*. Boston. 1848. Vol. III, p. 75. BOND, G. P.

——: 1848. Vol. III, p. 87. BOND, W. C.

American Academy of Arts and Sciences: *Proceedings*. Boston. Vol. I, pp. 165, 325, 342. BOND, W. C.

——: 1862-3. Vol. VI, p. 177. BOND, G. P.

American Journal of Science : [SILLIMAN'S.]

<i>Series.</i>	<i>Vol.</i>	<i>Page.</i>	<i>Author.</i>
1	XL	37	Mason.
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2	IV	427	Bond, W. C.
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2	IX	140	[Rosse.]
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3	VIII	75	[Huggins.]
3	IX	42	Abbe.
3	XI	341	Holden.
3	XIV	433	Holden.

Amer. Phil. Society Transactions : Vol. VII, p. 165. MASON, E. P., and SMITH, H. L.

American Ass. Adv. Science : 1870. p. 40. ABBE.

Amsterdam : *Tijdsch. van Wiss. en Nat. Wetens.* Vol. I, [1848]. p. 7. KAISER, F.

Angström : *Recherches sur le spectre solaire*, p. 37. [Duplicity of lines in spectrum of nebulae.]

Allgemeine Geog. Ephemeriden : iv, p. 269. [OLBERS.]

Arago : *Astronomie Populaire*, vol. i, p. 495, etc.

—— : *Analyse des Travaux de Sir WM. HERSCHEL.* *Ann. d. Bureau d. Long.* 1842, p. 410.

—— : *C. R.*, xiii, p. 450. [Remarks on RONDONI's drawing of nebula of Orion.]

—— : *C. R.*, xxvi, p. 50. [BOND's drawing of nebula of Orion.]

—— : *Edinburg New Phil. Jour.* Vol. 33, p. 307.

Aratus : *Diosemeia*, ver. 160, [mentions *Præsepe*.]

Argelander : *Astronomische Beobachtungen zu Bonn.*, 4°, Vols. iii, iv, v. *Durchmusterung.* [Introductions contain data for determining the distribution of stars in space, of the milky way, etc.]

—— : Maps in *Uranom. Nova.* give 19 nebulae, etc., visible to naked eye.

Argelander: Maps of *Durchmusterung* give 62 nebulae. [See LITTRON.]

——: *Rheinl. u. Westph. Sitzungsber.* xix, 1832, p. 79, [on a missing nebula.]

——: *A. N.*, lxxi, col. 287. [On an error in place of nebula in Bonn Zones—0°, No. 2436.] See PETERS, O. A. F.

Astronomische Gesellschaft: *Vierteljahrsschrift.*

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"		{ Bond, W. C.	"	207	Winnecke.
"		{ Everett, E.	"	243	Schmidt.
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XXXIX	262	Secchi.	"	353	Schmidt.
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"	261	Schmidt.	"	29	Tempel.
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"	81	Rümker, G.	"	137	Stephan.
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			"	355	Tempel.

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"	203	Liapounoff.	"	184	Proctor.
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"	164	Auwers.	"	226	Abbott.
"	242	Lassell.	"	228	Herschel, J.
"	248	Struve, O.	"	233	Airy.
"	277	Herschel, J.	"	235	Capt. J. Herschel.
XXIII	82	Chacornac.	"	249	Lassell.
"	228	Abbott.	XXXII	23	Stephan.
XXIV	7	[Liaponoff.]	"	61	Abbott.
"	65	Winnecke.	"	62	Proctor.
"	92	Hind.	"	151	Brünnnow.
"	171	{ Carpenter.	"	178	Gould.
"	177	{ Stone.	"	222	Russell.
"	206	Powell, E. B.	"	231	Stephan.
XXV	62	{ Bond, G. P.	"	359	Huggins.
"	109	{ Bond, W. C.	XXXIII	14	Proctor.
"	112	Lassell.	"	66	Russell.
"	153	Knott.	"	539	Proctor.
"	189	Huggins.	"	406	Waters.
"	191	Huggins.	"	433	Stephan.
"	192	Secchi.	"	558	Waters.
XXVI	65	Schultz, H.	XXXIV	75	Stephan.
"	71	Knott.	"	194	Gould.
"	208	Abbott.	"	248	Barneby.
XXVII	315	{ Carrington.	"	269	Ellery.
"	257	{ [Krüger.]	XXXV	135	Schultz.
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"	162	Gill.	XXXVI	61	Holden.
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		Key.	XXXVII	231	Holden.
		Secchi.	"	232	Stone.
		Abbott.	"	486	Plummer.

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- : *A. N.*, lviii, col. 361. [On the variability of No. 548, Bonn Zone + 30°; and observations.]
- : Verz. d. Oerter von 40 Nebelflecken, etc. *A. N.*, lviii, 1862, col. 369. [Also contains remarks on personal errors in observations of nebulae.]
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- : [Discovery of a new star in the nebula 80 M.] *A. N.*, liii, col. 294.
See *Mon. Not. R. A. S.*, xxi, p. 82.
- : [HIND's missing nebula of 1852.] *Mon. Not. R. A. S.*, xxii, p. 150.
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I have not been able to find this work.]
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Bekannten,] ib. p. 70.

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<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>	<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>
1779	65	Bode.	1799	235	Von Hahn.
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1782	155	Bode.	1801	128	Schroeter.
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1797	157	Von Hahn.	1818	97	Herschel, W.
1797	184	Von Hahn.	1821	149	Herschel, W.
1797	198	Schroeter.	1826	110	Olbers.
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 22, 23.
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 of G. C. 4532 [*dumb-bell*,] 4702, 116, 117, 807, 575, 600, *Nova*,
 1225, 1949, 1950, 2203-7, 2946, 8035, 8453, 4234, 4244, 4294,
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 4964, 5046.]
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<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>
1838	17	Herschel, J.
1845	President's Address.	Herschel, J.
1845	4	Rosse.
1849	53	Rosse.
1852	22	Rosse.
1862	14	Lassell.
1869	20	Robinson.

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——: Découverte de la lumière céleste qui paraît dans le Zodiaque. [Suspects nebulæ of *Andromeda* and *Orion* to be star clusters.] For the last two references see DELAMBRE, *Hist. de l'Ast. Moderne*, vol. ii, pp. 700, 709, 744.]

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1841	22	De Vico.
1850	141	Secchi.
1852	80	Secchi.
1856	3	Secchi.

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1783	-----	Catalogue.
1784	-----	Jaurat.
1784	227	{ Méchain.
1784	268	{ Messier.
1784	270	{ Lacaille.
1787	288	Messier.
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 —: *A. N.*, lvii, col. 345. [Variability of H. iv, 4.]
 —: *A. N.*, lviii, col. 1. [List of 50 double nebulae.]
 —: *A. N.*, lviii, col. 155. [No. 580 zone + 80° of Bonn zones. Variable nebula.]
 —: *A. N.*, lviii, col. 175. [List of nebulae in the Bonn zones.]
 —: *A. N.*, lix, col. 13. [On the *Mcrope* Nebula in the Pleiades; also on a second nebula in this group.]
 —: *A. N.*, lx, col. 377. [On CHACORNAC's variable nebula near ϵ *Tauri*; comet of 1792, II, etc.]
 —: *A. N.*, lxii, col. 197. [Ueber den Nebel II. i, 118.]
 —: *A. N.*, lxiii, col. 177. [Observations of some nebulae in Lord ROSSE's "list of nebulae not found."]
 —: *A. N.*, lxiii, col. 180. [List of 215 new nebulae.]
 —: *A. N.*, lxiv, col. 125. [On MESSIER 49; disappearance of a nebula observed by SCHMIDT in this group.]
 —: *A. N.*, lxv, col. 1. [Second list of new nebulae.]
 —: *A. N.*, lxviii, col. 251. [Three missing nebulae.]
 —: *A. N.*, lxx, col. 337. [LEFEBVRE's drawing of *Orion* nebula.]
 —: *A. N.*, lxxi, col. 143. [Nebula near HIND's variable.]
 —: *A. N.*, lxxix, col. 3. [Spectral lines of nebulae.]
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- : *V. J. S.*, 1876, p. 269. [Review of **SCHÖNFELD**, *Ast. Obs. Mannheim*, vol. ii;] and same vol. p. 276. [Review of **VOGEL**, Leipzig observations, 1876.] [**DREYER** also notes that the *Merope* variable nebula is not seen in Lord **ROSSE**'s telescopes.]
- : *A. N.*, lxxxviii, col. 359. [Announcement of his proposed supplement to **HERSCHEL**'s general catalogue of nebulae.]
- : *Mon. Not. R. A. S.*, xxxvii, p. 427. [Identification of some of **STEPHAN**'s nebulae.]
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- Ellery**: *Mon. Not. R. A. S.*, xxxiv, p. 269. [Note on η *Argus*.]
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- : [Has a series of observations on nebulae, made in 1865 and 1866, and as yet unpublished. See **VOGEL**'s *Beob. v. Nebelflecken*, etc., 1867, p. 85.]
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[——:] *Mon. Not. R. A. S.*, xxxiv, p. 194. [Notice of star-clusters photographed at Cordoba.]

Gould's Astronomical Journal:

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I	47	Petersen.
II	95	Alexander, D.
II	180	D'Arrest.
II	178	Gilliss.
III	71	{ Petersen.
		{ [Secchi.]
V	16	Peters, C. H. F.

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Hahn, Von: *B. J.*, 1797, p. 157. [Nebula of *Orion*.]

——: *B. J.*, 1797, p. 250. [Nebula of *Andromeda*.]

——. Gedanken über den Nebelfleck in *Orion*. *B. J.*, 1799, p. 235. [Suggests that this nebula may gradually concentrate into stars.]

——: Beob. u. Gedanken u. die Gegend des gestirnten Himmels beim nördl. Flügel der Jungfrau. *B. J.*, 1801, p. 178.

——: Ueber den planetarischen Nebelfleck bei μ *Hydræ*. *B. J.*, 1802, p. 231. [Suggestions as to a means of detecting a motion of rotation in this nebula.]

——: Ueber *Mira Ceti* als Nebelsterne, Nebel der *Leyer* u. d. *Hydra*. *B. J.*, 1803, p. 106.

——: *B. J.*, 1807, p. 152. [Ueber die Stoffe im Weltraum, etc.]

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I	lxvii	Bond, W. C.
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VIII	58	{ Winlock.
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VIII	Part ii and Plates.	{ Bond, G. P.
		{ Winlock.
		{ Trouvelot.

[**Heis:**] His *Atlas Cœlestis* contains 6 nebulæ visible to the naked eye.

[——:] [Is said to have made many drawings of nebulæ. *Nature*, 1877, July 12, p. 213.]

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- Herschel, J.:** Account, etc., of the Nebula in *Orion*, and observations on the nebula of *Andromeda*. *Mem. R. A. S.*, vol. ii, p. 487, with a plate.
- : [On the fifth star of the trapezium of *Orion*.] *Mem. R. A. S.*, iii, p. 189. See also page 187. [HERSCHEL and RAMAGE.]
- : A list of test objects, etc. *Mem. R. A. S.*, viii, p. 21.
- : *Mem. R. A. S.*, vol. vi, p. 78. [Connection of double stars with nebulae.]
- : Observations on nebulae at the Cape of Good Hope. *Report B. A. S.*, 1838, part ii, p. 17.
- : *Report B. A. S.*, 1845, President's address. [General account of nebular science; belief that elliptical nebulae are in general stellar.]
- : *Bull. Sci. de l'Ac. Imp. de St. Pet.*, vol. iv, 1838, p. 238. [Letter to W. STRUVE on G. C. H. Observations.]
- : *A. N.*, xii, col. 274. [Observations at Cape of Good Hope.]
- : Account of nebulae observed at the Cape of Good Hope. *Mon. Not. R. A. S.*, iii, p. 75.
- : [Missing nebula in *Coma Berenices*.] *Mon. Not. R. A. S.*, xxii, p. 248.
- : [Nebula round η *Argus*.] *Mon. Not. R. A. S.*, xxviii, p. 225, and xxxi, p. 228.
- : [Nebula round η *Argus*.] [Spectra of southern nebulae.] *Mon. Not. R. A. S.*, xxix, p. 82; see p. 164.
- : Observations on 2307 nebulae, made at Slough. *P. T.*, 1833, p. 359. [Figures of 67.]
- : General catalogue of nebulae and clusters of stars. *P. T.*, 1864, p. 1. [5079 nebulae.]
- : Nebula of *Orion*. *Obs. C. G. H.*, p. 25, with plate.
- [——]: *Am. Jour. Sci.*, 2d series, v. p. 86.
- Herschel, Capt. J.:** *Mon. Not. R. A. S.*, vol. xxix, p. 82. [η *Argus*.]
- : *Mon. Not. R. A. S.*, xxxi, p. 235. [Nebula in *Argo*.]
- : Spectra of southern nebulae. *Proc. R. S.*, vol. xvi, 1867-8, pp. 417 and 451. [Contains observations of spectrum of *Orion* nebula.]
- : *Proc. R. S.*, xvii, 303.
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- : Ueber die Natur u. den Bau der Sonne u. Fixsterno. [Translation from *P. T.*, 1801,] p. 65, *Sammlung Astron. Abhand.*, [BODE.] Berlin, 1795

- Herschel, W.:** *C. G. H. Obs'ns*, p. 128. [Catalogue of 8 nebulae discovered by him and not elsewhere published.]
- : *Mem. R. A. S.* i, p. 167. Observations of M. 20=G. C. 4355.
- : *B. J.*, 1787, p. 213. [Letter to BODE, describing the contents of his memoir "On the Construction of the Heavens." 1785.]
- : *Entdeckung [einiger] Nebelflecken*, etc. *B. J.*, 1788, p. 238. [Translation from "On the Construction of the Heavens." 1785.]
- : *Verz. von 1,000 neuen Nebelflecken.* *B. J.*, 1791, p. 157.
- : *Verz. von 1,000 neuen Nebelflecken.* *B. J.*, 1794, p. 151.
- : *Ueber die Anordnung des Weltgebäudes*, [translated by FISCHER.] *B. J.*, 1794, pp. 213 and 226.
- : *B. J.*, 1795, p. 65.
- : *Ueber die eigentlichen Nebelsterne.* *B. J.*, 1801, p. 128, [translation from *P. T.*, 1791.]
- : *On the power of penetrating into space by telescopes*, [translated by IDELER.] *B. J.*, 1804, p. 231.
- : *Ueber den Nebelfleck H. i. 7*, etc. *B. J.*, 1805, p. 211. [Correction of an error in its place.]
- : *Ueber den Bau des Himmels*, [translated by IDELER.] *B. J.*, 1807, p. 113.
- : *Verz. von 500 neuen Nebelflecken.* *B. J.*, 1807, p. 129.
- : *Ast. observations relating to the sidereal part of the Heavens and its connection with the nebulous part*, [translated by BRANDES.] *B. J.*, 1818, p. 97.
- : *Einige merkwürdigen Stellen der Milchstrasse.* *B. J.*, 1821, p. 149.

Abstracts of Sir William Herschel's Memoirs in the Philosophical Transactions.

<i>A.D.</i>	<i>Vol.</i>	<i>P.</i>	
1784	74	437	<i>Account of some observations tending to investigate the Construction of the Heavens.</i>
		438	Resolution of the milky way.
		439	Number of stars visible in field of the 20-foot telescope.
		440	Examination of MESSIER's nebulae.
		442	Arrangement of nebulae and clusters in <i>strata</i> , sometimes of great length.
		443	Sun near the centre of the milky way.
		445	Star gauging defined.
		446	Table of results of star gauging from 15 ^h 10 ^m to 16 ^h 37 ^m R. A. and from 92° to 94° N. P. D., and 11 ^h 16 ^m to 14 ^h 30 ^m and 78° to 80° N. P. D.

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.*A D. Vol. P.*

- 1784 74 448 The solar motion explained by the situation of the sun in the milky way.
- 448 Local distribution of nebulae—nebulae surrounded by spaces vacant of stars.
- 449 Strata of *Cancer* and *Coma Berenices* described.
With this memoir is a plate of figures of nebulae. Plate xvii, fig. 1, M. 98; 2, M. 53; 3, H., ii, 28, [resolvable;] 4, H., i, 18; 5, H., iii, 15; 6, H., iv, 5; 7, H., iv, 2; 8, H., iv, 3; 9, 10; 11, H., i, 18; 12, 13, 14, 15?
Also Plate xviii, construction of the heavens—cloven disc.
- 1785 75 218 *On the Construction of the Heavens.*
- 214 Theoretical view of the formation of nebulae.
Form I. Condensation of neighboring stars about a central and larger star: globular forms.
- 215 *Form II.* Condensation of neighboring stars about a nucleus of contiguous stars: condensed irregular forms.
Form III. Condensation about a stream of stars, producing a form coarsely similar to the prototype: extended, branching, compound forms.
- 216 *Form IV.* Compound forms derived from the mutual attraction of clusters.
V. Vacancies will then arise in the surrounding space.
Objection to the above views; they tend to show a gradual destruction of the universe. Response, that space is infinite and that the occasional destruction of one star may operate to give life to the rest.
- 217 Optical appearances to an observer within a nebula of the third form.
- 219 Results of observation—star gauges.
- 221–240 Gauges throughout the 24^h in R. A. Results given in detail.
- 241 The stars being supposed to be nearly equally scattered, and their number in a field of view of known angular diameter being given, to determine the length of the visual ray. Solution of the problem.
- 248 Another solution.
- 244 Proof that the sun is situated in a compound nebula of Form III.
- 253 Section of our sidereal system.
- 254 Origin of nebulous strata.
- 256 M. 80 and M. 4 on the edges of vacancies.
- 257 Phenomena at the Poles of our nebula.

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

- A.D. Vol. P.*
 1785 75 258 Enumeration of very compound nebulae or milky way.
 Ten described, including that of *Orion* and *Andromeda*.
 263 Account of nebula of *Lyra*. G. C., 4447.
 Planetary nebulae. Observations of G. C., 4628, 4964,
 4572, 4565, 826, 2102, 4302.
 The accompanying plate gives a figure of a section of the
 milky way.
- 1786 76 457 *Catalogue of one thousand New Nebulae and Clusters of
 Stars.*
 Description of sweeping telescope; Newtonian; 20 feet
 focus, 18.7 in. aperture, power 157, field 15' 4".
 458 Description of the method of sweeping.
 464 Probable errors of the places given by the sweeps before
 1783, Dec. 13, $\Delta\alpha = 1''$, $\Delta\delta 8'-10'$, during 1784 $\Delta\alpha$
 $< 30''$, $\Delta\delta < 5'$.
 Till 1785, September 24, $\Delta\alpha < 12''$, $\Delta\delta < 4'$.
 After 1786, April, $\Delta\alpha < 6''$, $\Delta\delta < 2'$.
 466 Definition of *classes* of nebulae and clusters.
 467 A map of positions of nebulae was made for identification.
 469 Explanation of a short method of describing appearance of
 nebulae by letters.
 471 Catalogue:
 Class I No. 1 to No. 93
 II No. 1 to No. 402
 III No. 1 to No. 376
 IV No. 1 to No. 29
 V No. 1 to No. 24
 VI No. 1 to No. 19
 VII No. 1 to No. 17
 VIII No. 1 to No. 40
 498 Notes to special nebulae.
- 1789 79 212 *Catalogue of a second thousand of New Nebulae and Clusters
 of Stars; with a few introductory Remarks on the Con-
 struction of the Heavens.*
 218 A telescope has power to penetrate into space. Proof that
 every star is a sun shining by its native brightness.
 214 Systems of stars—globular clusters and definition of a clus-
 ter.
 216 Admitting that a cluster is real, not apparent, the stars com-
 posing it are about of equal magnitude.
 217 At the same distance from the centre an equal scattering
 takes place.
 These clusters are of a globular form.
 218 They are more condensed at the centre than at the surface.

Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.

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- 1789 79 219 Form I of nebulae, [*P. T.*, 1785, p. 214,] is thus shown to exist in the heavens.
Such clusters are subject to central powers.
- 220 The idea of other central forces [than that of gravity] in the construction of the sidereal heavens, was given in certain mathematical papers delivered to the Phil. Soc. of Bath, [and is yet entertained.]
- 221 Not only were *round* nebulae and clusters formed by central powers, but likewise every cluster of stars or nebula that shows a gradual condensation, or increasing brightness towards a centre.
- 222 This theory of central power is fully established on grounds [of observation] which cannot be overturned.
- 223 Clusters can be found of 10' diameter with a certain degree of compression and stars of a certain magnitude, and smaller clusters of 4' 3' 2' in diameter, with smaller stars and greater compression, and so on through resolvable nebulae by imperceptible steps, to the smallest and faintest [and most distant] nebulae.
- 224 Other clusters there are, which lead to the belief that either they are more compressed or are composed of larger stars. Spherical clusters are probably not more different in size among themselves than different individuals of plants of the same species. As it has been shown that the spherical figure of a cluster of stars is owing to central powers, it follows that those clusters which, *ceteris paribus*, are the most complete in this figure, must have been the longest exposed to the action of these causes.
- 225 The maturity of a sidereal system may thus be judged from the disposition of the component parts.
Planetary nebulae may be looked on as very aged.
- 226 Though we cannot see any individual nebula pass through all its stages of life, we can select particular ones in each peculiar stage.
- 226 Catalogue:
- | | | | |
|---------|---------|----|---------|
| Class I | No. 94 | to | No. 215 |
| II | No. 403 | to | No. 768 |
| III | No. 377 | to | No. 747 |
| IV | No. 30 | to | No. 58 |
| V | No. 25 | to | No. 44 |
| VI | No. 20 | to | No. 35 |
| VII | No. 18 | to | No. 55 |
| VIII | No. 41 | to | No. 78 |
- 255 Notes.

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

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- 1791 81 71 *On Nebulous Stars properly so called.*
The name nebulous stars incorrectly used in former times.
- 72 Nebulæ can be selected so that an insensible gradation shall take place from a coarse cluster like the *Pleiades* down to a milky nebulosity like that in *Orion*, every intermediate step being represented. This tends to confirm the hypothesis that all are composed of stars more or less remote.
- 73 A comparison of the two *extremes* of the series, as a coarse cluster and a nebulous star, indicates, however, that *the nebulosity about the star is not of a starry nature.*
- 74 Summary of the reason which led to the belief that all nebulæ were clusters more or less remote.
Basis for the ideas of *connection* and *disjunction* of stars and nebulæ.
- 75-77 Particular examples of such supposed conjunctions and disassociations.
The trapezium of *Orion* is unconnected with the nebula.
- 78-82 Notes of observations on nebulous stars and consideration of the relation of the nucleus to the envelope in each case.
- 83 Considering H, iv 69, [= G. C. 810,] as a typical nebulous star, and supposing the nucleus and chevelure to be connected, we may, 1st, suppose the whole to be of stars, in which case either the nucleus is enormously larger than other stars of its stellar magnitude or the envelope is composed of stars indefinitely small; or, 2d, we must admit that the star is *involved in a shining fluid of a nature totally unknown to us.*
- 84 The *telescopic milky way* is probably composed of this shining fluid, which must commence somewhere about the range of the stars of the 7th magnitude, and extend to the regions of the 9th, 10th, 11th, and 12th.
- 85 The shining fluid might exist independently of stars. The light of this fluid is no kind of reflection from the star in the centre. If this matter is self-luminous, it seems more fit to produce a star by its condensation than to depend on the star for its existence.
- 86 List of diffused nebulosities and planetary nebulæ; both better accounted for by the hypothesis of a shining fluid than by supposing them to be distant stars.
Regeneration of stars from planetary nebulæ.
- 87 How far the light-corpuscles emitted from millions of suns may be concerned in this shining fluid it is not neces-

Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.

- | A.D. | Vol. | P. | |
|------|------|---------|---|
| 1791 | 81 | 88 | sary to inquire—we need not know the origin of the luminous matter whose existence is rendered evident by means of nebulous stars. |
| 1795 | 85 | 46 | <i>On the Nature and Construction of the Sun and Fixed Stars.</i> |
| | | 69 | Speculations on the Satellites of Fixed Stars; the mutual distance of the component stars of condensed clusters, and on the distances of the clusters themselves, etc. |
| | | 70 | Star gauges. $19^h.6$ to $20^h.2$; N. P. D. = $78^{\circ}.9$. |
| 1796 | 86 | 166 | <i>Method of observing the Changes that happen to the Fixed stars, etc.</i> |
| 1800 | 90 | 49 | <i>On the power of penetrating into Space by telescopes, etc.</i> |
| | | 68 | Relative distance from the earth of cluster in <i>Perseus</i> and other clusters. |
| | | 70–78 | Observations in detail of several nebulae, each with various telescopes. |
| 1802 | 92 | 477 | <i>Catalogue of 500 new Nebulae, Nebulous Stars, Planetary Nebulae and Clusters of Stars; with remarks on the Construction of the Heavens.</i> |
| | | | After a sufficient number of celestial objects is found, there is a necessity for a scientific classification. The former classification was only for the convenience of the observer. |
| | | 478 | Enumeration of the parts that enter into the construction of the heavens. |
| | | | I. <i>Of insulated stars.</i> |
| | | 479 | Notion of an insulated star—our sun is one. |
| | | 480 | The milky way consists of stars very differently scattered from those which are immediately about us. |
| | | | II. <i>Of Binary Siderial Systems or Double Stars.</i> |
| | | 480–485 | Theoretical notions of such systems. |
| | | 486 | Many of them have already changed their situation with regard to each other in a progressive course, denoting a periodical revolution round each other. |
| | | | Our sun does not belong to such a system. |
| | | | III. <i>Of more complicated Siderial Systems, or treble, quadruple, quintuple, and multiple stars.</i> |
| | | 487 | Theorem as to the permanent connection of revolving stars, when the forces acting on any one of them reduced to a direction as coming from the empty centre, are in the direct ratio of the distances from that centre. |

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

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1802 92 487-495 Hypothetical examples of such connections.

495 IV. *Of Clustering Stars and the Milky Way.*Marks of clustering in the milky way. Example of the stars between β and ζ Cygni.

496 "We may indeed partly ascribe the increase, both of brightness and of apparent compression, to a greater depth of the space which contains these stars; but this will equally tend to show their clustering condition, for since the increase of brightness is gradual, the space containing the clustering stars must tend to a spherical form if the gradual increase of brightness is to be explained by the situation of the stars."

V. *Of groups of Stars.* Definition.497 VI. *Of clusters of Stars.* Definition.VII. *Of Nebulæ.* Perhaps they are all to be-resolved into the three last-mentioned species.

498 Power of a telescope to penetrate not only space but time [past.]

499 VIII. *Of Stars with Burs or Stellar Nebulæ.*IX. *Of Milky Nebulosity.*

Probably of two kinds. 1st, apparent, which is formed by distant ["widely-extended"] clustering stars, and, 2d, real, and possibly at no very great distance from us. The nebula of Orion of this latter kind.

500 X. *Of Nebulous Stars.*501 XI. *Of Planetary Nebulæ.*

Perhaps they are allied to nebulous stars.

XII. *Of Planetary Nebulæ with Centres.*

508 Catalogue.

Class I	No. 216	to	No. 288
II	No. 769	to	No. 907
III	No. 748	to	No. 978
IV	No. 59	to	No. 78
V	No. 45	to	No. 52
VI	No. 36	to	No. 42
VII	No. 56	to	No. 67
VIII	No. 79	to	No. 88

1811 101 269 *Astronomical Observations relating to the Construction of the Heavens, arranged for the purpose of a critical examination, the result of which appears to throw some new light on the Organization of the Celestial bodies.*

[The following analysis is by HERSCHEL himself.]

Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.*A.D. Vol. P.*

- 1811 101 272 Diffused nebulosity exists in great abundance.
 275 Observations of more than one hundred and fifty square degrees of it.
 277 Its abundance exceeds all imagination.
 Nebulous matter consists of substances that give out light, which may have many other properties.
 278–281 Nebulous diffusions contain both milky nebulosity, and such as from its faint appearance may be mistaken for resolvable.
 278–279 The range of its visibility is confined to very moderate limits.
 280 The purpose for which such great abundance of nebulosity may exist, deserves investigation.
 282 Either greater depth or greater compression of the nebulous matter may occasion greater brightness.
 284 Condensation will best account for greater brightness.
 The condensation of the nebulous matter ascribed to gravitation.
 285 When a nebula has more than one preponderating seat of attracting matter, it will probably in time be divided.
 This conception is supported by the appearance of double nebulae.
 286 Their double appearance can be no deception.
 Their nebulosity is derived from one common stock.
 290 This opinion is supported by the remarkable situation of nebulae.
 292 Which may be seen in Mr. BOND's *Atlas Cœlestis*.
 293–296 The real form of the nebulous matter of which nebulae are composed may be inferred from their figure.
 299 The form of the nebulous matter of round nebulae is globular.
 This form is caused by gravitation.
 302 The central brightness of nebulae points out the seat of attraction.
 The effect of attraction on the form of the nebulous matter depends on its original expansion, on the time of the action and on the quantity of the attracting matter.
 305 III different stages of condensation pointed out.
 306 Comets may be highly condensed nebulae.
 307 Progressive condensation takes place.
 308 Concentric brightness as well as globular form indicates the general gravitation of the nebulous matter.
 Progressive condensation may be seen in the formation of nuclei.

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

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1811 101 309-310 Nebulous matter is probably capable of being consolidated; the act of shining proves it to have chemical properties.

It will stop light, and is partly opaque.

811 Queries relating to the subsidence of the nebulous matter, the zodiacal light, and the cause of rotatory motion.

813 Some part of the nebulous matter is probably elastic.

813 The uniform light of nuclei, and of much condensed nebulae, proves that the nebulous matter is considerably opaque.

814 When the nebulous matter assumes hardness, the progress of condensation will be impeded.

815 Three indications of the compression of the nebulous matter.

Planetary appearance arises from superficial lustre.

816 High degree of condensation of the nebulous matter.

A still higher degree of condensation.

818 In common good telescopes planetary nebulae cannot be distinguished from stars.

Perhaps they may in the end be so condensed as actually to become stars.

819 The nebulous matter in a cubical space of 10' will admit of a condensation of two trillion and 208 thousand billion times before it can go into the compass of a globe of the diameter of our sun.

Planetary nebulae have a rotatory motion on their axes.

The original eccentricity of the nebulous matter of a nebula may be the physical cause of the rotatory motion of celestial bodies.

820 The nebulous star in *Orion* is fictitious.

821 Two out of three nebulous stars in *Orion* have lost their former nebulous appearance.

Their fictitious appearance was owing to a dispersion of their light in passing through nebulous matter.

822 The faintest appearance of the nebulosity in *Orion* is perhaps not further from us than the stars of the third or second magnitude; the brightest part is therefore probably not so far.

823 In thirty-seven years the nebulosity of this nebula has undergone great changes, and much greater since the time of HUYGHENS.

824 Nebulae are not permanent celestial bodies.

825 Additional proof of the opacity of the nebulous matter.

Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

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- 1811 101 325 Very distant nebulosities which cannot be seen in a state of diffusion may become visible when condensed into separate nebulæ.
- 327 Conversion of planetary into bright stellar nebulæ, into stars with burs, or stars with haziness.
- 329 Conversion of more distant ones into faint stellar nebulæ, into stars with burs or with faint chevelure.
When it is doubtful whether an object is a star or a nebula, it may be verified by an increase of magnifying power.
- 330 When the object is very like a star it becomes difficult to ascertain whether it is a star or a nebula.
When we cannot ascertain whether the doubtful object is a star or a nebula, of which several instances are given, the similitude is as great as any we can expect; for were it greater there could be no doubt.
- 1814 104 243 *Astronomical Observations relating to the Siderial part of the Heavens and its Connection with the Nebulous part; arranged for the purpose of a critical examination.*
In the memoir on the nebulous part of the heavens [P. T. 1811] I have endeavored to show the probability of a very gradual conversion of the nebulous matter into the siderial appearance.
- 249 I. *Of stars in remarkable situations in regard to Nebulæ.*
Surmise that nebulæ may have considerable proper motions.
Necessity of caution in such conclusions. Five stars in such situations.
- 250 II. *Of two stars with nebulosity between them.*
19 instances of such connection are given; in the memoir of 1811, 139 double nebulæ joined by nebulosity were noted.
- 251 Should we not surmise that possibly these stars had formerly been highly condensed nebulæ like those that had been mentioned, and were now by gradually increasing condensation turned into small stars; and may not the nebulosity still remaining show their nebulous origin? Also we have over 700* double stars free from nebulosity, many of which are probably at no great real distance from us, it seems as if we had these double objects in three different successive conditions. 1st, as nebulæ; next as stars with remaining nebulosity; and lastly, as stars completely free from nebulous appearance.

[* 10,000 or more in 1876. As comparatively few are nebulous, either our system is in an advanced state or the order here given is exceptional.]

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1814 104 251 III. *Of Stars with nebulosity of various shapes attached to them.*

252 Fourteen such objects noted.

Now, if we admit a contact between these nebulae and the stars, it deserves to be remarked that stars in the situation of these fourteen cannot have been formed from their adjoining nebulosities; for a gradual condensation of the nebulous matter would have been central; whereas the stars are at the extremity of the nebulae. Their connection is then due to some motion either of the star or of the nebulae. If the nebulosity should subside into the star, it would give an idea of the *growth* of a star.

253 IV. *Of stars with nebulous branches.*

Three cases noted of a connection between stars and nebulae and reference made to *P. T.*, 1811, pp. 301-311, for further examples.

254 V. *Of nebulous stars.*

Thirteen are noted—see also *P. T.*, 1791, p. 71.

255 Nebulous stars are not only connected with a nebulosity, which, from its great regularity, might be taken for an atmosphere, but also with the luminous appearances belonging to the nebulous matter which is so widely expanded in various regions of the heavens.

What has been said of the gradual condensation of the nebulous matter in the case of extended nebulae, is supported by a much greater number of nebulosities in a spherical form. [See *P. T.*, 1811, pp. 301-8.] 322 cases are there mentioned, in which the fact of the gradual condensation is rendered so evident as not to admit of a doubt.

256 Nebulous stars only differ from round nebulae containing a nucleus, in the degree of condensation.

256 VI. *Of Stars connected with extensive windings of nebulosity.*

Three cases noted.

The nebulosity which has been shown to be connected with stars, may be fully proved to be of the same nature as the general mass of nebulous matter.

Stars of this class are in a condition of growth.

257 Possibility that stars were originally formed by a condensation of the nebulous matter.

We may conceive both the generation and growth of stars to be the legitimate effects of the law of gravitation, to

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which the nebulous matter is proved by observation to be subject.

1814 104 257 VII. *Of small patches consisting of Stars mixed with nebulosity.*

Thirty-seven cases noted.

The connection may be only apparent—admitting it to be real :

1st, it may happen that the nebulosity still mixed with the stars is some remaining unsubsided part of that from which they were formed ; or, 2d, the union of stars and nebulosity may have been affected by the motion of either the stars or the nebulosity.

258 Such motions do take place. Nebulæ are subject to great changes in their appearance, as the nebula of *Orion*. [*P. T.*, 1811, p. 320.]

259 Every nebulosity which is carried into the region of a small patch of stars will probably be gradually arrested and absorbed by them, and the *growth of stars* thus continued.

VIII. *Of objects of an ambiguous construction.*

Clusters of stars at a great distance may assume a nebulous appearance. [*P. T.*, 1811, p. 270.]

Telescopes of gradually increasing space-penetrating powers show certain objects successively as nebulæ, mixtures of nebulosity and stars, and as true clusters ; other objects, so viewed, increase in brightness, and the nebulosity becomes more uniformly united and of a milky appearance, and these are purely nebulous.

260 Definition of *ambiguous* objects, their classification and examples. Seventy-one such noted in four classes.

Class 1. Seven objects, which may be supposed to consist of stars, but where observations leave it doubtful.

261 *Class 2.* Twenty-six objects of round or nearly round figure. The round figure of these show them to be *globular*. They must either be in a condensed state purely nebulous, or else if consisting of stars, they must be in an advanced order of compression, and only appear nebulous on account of their very great distance from us.

A middle state between the progressive condensation of a globular nebula and a cluster of stars can have no existence, because a globular nebulosity when condensed can only produce a single star. A globular cluster may, however, intercept a mass of nebulous matter in motion,

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in which case the nebulosity must soon assume the form of the cluster, and will finally be absorbed by it.

Class 3. Twenty-six easily resolvable objects.

1814 104 262 *Class 4.* Twelve objects, probably clusters.

IX. Of the sidereal part of the Heavens.

Intimate connection between the nebulous and sidereal condition.

263 Stars of first magnitude. [See *P. T.*, 1785, p. 68.]

264 Prismatic analysis of the light of *Sirius*, a *Orionis*, *Procyon*, *Arcturus*, *Aldebaran* and a *Lyræ*.*

265 *X. Of the aggregation of stars.*

Star-gauges prove that the stars are not equally distributed over the celestial regions.

Forming clusters. This tendency to clustering is chiefly visible in places extremely rich in stars. Its greatest effects will then be in and near the milky way.

266 The twenty objects referred to are not given as instances of the actual formation of clusters, but merely to draw attention to a seemingly aggregating arrangement. Fifteen of these are in the milky way and five are near it.

266 *XI. Of irregular clusters.*

Clusters in very rich parts of the heavens are generally of irregular form and imperfectly collected. One hundred and twelve such objects are referred to; eighty of size not noted, fifty-three of these in the milky way, eighteen near it, nine at a distance from it. Also thirty-two irregular clusters from 2' to 30' in diameter; of these twenty-two are in the milky way and ten near it.

267 The great number of clusters in these two collections is not only an indication that they owe their origin to a clustering power residing in the centre; but the still remaining irregularity of their arrangement additionally proves that the action of the clustering power has not been exerted long enough to produce a more artificial construction.

268 *XII. Of clusters variously extended and compressed.*

Fifteen extended clusters named; twelve in the milky way, three near it. Their descriptions show that the power which has drawn the stars together has acted under different circumstances in the several cases.

[* I believe that these experiments of HERSCHEL's have been hitherto overlooked, at least I have seen no mention of them in historical works.

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XIII. *Of clusters of stars of a peculiar description.*

Six such objects named : One in the milky way, three near it, two at a distance from it.

271 XIV. *Of differently compressed clusters of stars.*

I have hitherto only considered the arrangement of stars in clusters with a view to point out whether they are drawn together by a clustering power in the same manner as the nebulous matter has been proved to be condensed by a gravitating principle ; but in the forty-one clusters of the following two collections we shall see that it is one and the same power uniformly exerted which first condensed nebulous matter into stars and afterwards draws them together into clusters, and which by a continuance of its action, gradually increases the compression of the stars which form the clusters. The first collection has thirty-three considerably compressed clusters, seventeen in the milky way, fifteen near it, and one at a distance. The second collection contains eight clusters, highly compressed, five in the milky way, two near it, and one at a distance.

272 XV. *Of the gradual concentration and insulation of clusters of stars.*

The existence of a clustering power is nowhere so visibly pointed out as in the thirty-nine clusters given in the following collection : Twenty-one of these are in the milky way, seven near it, and eleven at a distance.

273 XVI. *Of globular clusters of stars.*

Fourteen such objects noted : One in the milky way, four near it, and nine at a distance from it.

274-7 [Detailed accounts from observing books of M. 72 ; M. 2 ; M. 5 ; M. 56 ; M. 80 ; M. 13 ; M. 3 ; M. 15 ; M. 79 ; M. 19 ; M. 58.]**278 XVII. *Of more distant globular clusters of stars.***

The following eleven objects are so like those of the foregoing collection that I have called them miniatures of the former. Five of these are in the milky way, one near it, and five at a distance. Detailed descriptions given.

279 I have supposed the clusters of this class to be at a greater distance from us than those of the preceding collection, because the stars of which they are composed are more minute than those of the clusters of which I have called them miniatures ; their compression is also closer, and the size of the whole is much contracted, all of which

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particulars are readily explained by admitting them to be more distant. This argument, however, does not extend so far as to exclude a real difference which there may be in different clusters, not only in the size, but also in the number and arrangement of the stars.

XVIII. *Of still more distant globular clusters of stars.*

- 1814 104 280 It has frequently happened that I saw three objects in succession, the first of which was a brilliant globular cluster of stars, the second a miniature of the former in which the stars could just be perceived, and the third in every respect a similar miniature of the second, as the second was of the first, but in which the stars, though suspected, were no longer to be distinguished. Five such objects given, all in the milky way.

XIX. *Of a recurrence of the ambiguous limit of observation.*

- 281 It has already been shown [VIII] that in passing from faint nebulosity to the suspected siderial condition we cannot avoid meeting with ambiguous objects, and the same critical situation will again occur, when, from the distinctly siderial appearance, we endeavor to penetrate gradually further into space.

The effects of clustering power have been gradually traced from the first indication of clustering stars through irregular as well as through more artificially arranged clusters up to the beautiful globular form.

The extended views I have taken in this and in my former papers of the various parts that enter into the construction of the heavens have prepared the way for a final investigation of the universal arrangement of all these celestial bodies in space. The *scale* is still wanting by which distances are to be measured.

- 282 **XX. *Of the breaking up of the Milky Way.***

Its whitish tinge has been proved by star-gauges to arise from accumulated stars. It does not now consist of equally scattered stars.

- 283 One hundred and fifty-seven instances have been given of clusters situated within the milky way. Sixty-eight more are in the borders. Now, since the stars of the milky way are permanently exposed to the action of a power whereby they are irresistably drawn into groups, we may be certain that from mere clustering stars they will be gradually compressed through successive stages of accumulation till they come up to what may be called

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the ripening period of the globular form, and total insulation; from which it is evident that the milky way must be finally broken up and cease to be a stratum of scattered stars.

- 1814 104 284 The state into which the incessant action of the clustering power has brought it at present is a kind of chronometer that may be used to measure the time of its past and future existence; and although we do not know the rate of going of this mysterious chronometer, it is nevertheless certain that since the breaking up of the milky way affords a proof that it cannot last forever, it equally bears witness that its past duration cannot be admitted to be infinite.

This paper is accompanied by Plate IX, p. 284, with 17 figures.

Fig. 1 = H. v, 46.	10 = H. iii, 697.
2 = H. iii, 67.	11 = H. ii, 101.
3 = H. ii, 706.	12 = H. ii, 500.
4 = H. i, 143.	13 = H. viii, 44.
5 = H. iv, 4.	14 = H. viii, 4.
6 = H. iv, 35.	15 = H. vi, 36.
7 = H. iv, 42.	16 = H. vi, 5.
8 = H. iv, 69.	17 = M. 72.
9 = H. iv, 33.	

- 1817 107 802 *Astronomical Observations and Experiments tending to investigate the Local Arrangement of the Celestial Bodies in Space and to determine the Extent and Condition of the Milky Way.*

The construction of the heavens can only be known when we have the situation of each body defined by its three dimensions. Of these three the ordinary catalogues give but two, leaving the distance or profundity undetermined.

- 303 The method of parallaxes has given the distance of the sun, planets, etc. The parallax of the stars has also received attention. With regard to more distant objects, as small stars, compressed clusters, and nebulae, these methods are of no avail.

I. *Of the local situation of the stars of the Heavens.*

- 304 It is evident that we cannot mean to affirm that the stars of the fifth, sixth, and seventh magnitudes are really smaller than those of the first, second, or third, and that we must ascribe the cause of the difference in the apparent magnitudes of the stars to a difference in their relative distances from us. On account of the great number

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of stars in each class we must also allow that the stars of each succeeding magnitude beginning with the first, are, one with another, further from us than those of the magnitude immediately preceding. The relative magnitudes give only relative distances, and can afford no information as to the real distances at which the stars are placed.

II. *Of a standard by which the relative arrangement of the stars may be examined.*

A standard of reference for the arrangement of the stars may be had by comparing their distribution to a certain properly modified equality of scattering. The equality which I propose does not require that the stars should be at equal distances from each other, nor is it necessary that all those of the same nominal magnitude should be equally distant from us.

1817 107 805 It consists in allotting a certain equal portion of space to every star, in consequence of which we may calculate how many stars any given extent of space may contain. This arrangement is explained by means of a figure. Plate XV, Fig. 1.

806 III. *Comparison of the order of magnitudes with the order of distances.*

Comparison of the order of distances by the foregoing scheme with the magnitudes assigned in BODE's catalogue of 14,144 stars.

808 The result of this comparison is, that if the order of magnitudes could indicate the distance of the stars, it would denote at first a gradual, and afterwards a very abrupt, condensation of them; but that, considering the principle on which the stars are classed, their arrangement into magnitudes can only apply to certain relative distances, and show that, taking the stars of each class, one with another, those of the succeeding magnitudes are farther from us than the stars of the preceding order.

IV. *Of a criterion for ascertaining the profundity or local situation of celestial objects in space.*

809 It will be admitted that those stars, the light of which we can experimentally prove to be $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$ -----of the light of any certain star of the first magnitude must be 2, 3, 4-----times as far from us as the standard star, provided the condition of the stars should come up to the supposed mean state of diameter and lustre of the standard star.

V. *Of the equalization of star light.*

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- Star gauging gave rise to an investigation of the space-penetrating power of telescopes.
- 1817 107 810 Finding that this might be calculated with reference to the extent of the same power of which the unassisted eye was capable, there always remained a desideratum of some sure method by which this last might be ascertained.
- Description of experimental apparatus.
- 811 Method of limiting apertures.
- 813 VI. *Of the extent of natural vision.*
- 813-8 Experiments on stars.
- 818 The distances of clusters cannot be ascertained by the method of equalizing star-light.
- VII. *Of the extent of telescopic vision.*
- 819 Experiments which go to show that the diameter of the pupil of the human eye is not more than 0.21 inch, and greater than 0.17 when observing with a telescope. It may be assumed 0.2 inch.
- 820 VIII. *Application of the extent of natural and telescopic vision to the probable arrangement of the celestial bodies in space.*
- We shall be able to say that a distant celestial object is so far from us, provided the stars of which it is composed are of a size and lustre equal to the size and lustre of such stars as *Sirius*, *Arcturus*, etc.
- 821 The stars of the tenth, eleventh, and twelfth order of distances are not only more compressed than those in the neighborhood of the sun, but, moreover, their compression in different parts of the heavens must be very unequal.
- IX. *Of the construction and extent of the milky way.*
- 822 General description of it.
- The sun is within its plane, for to an observer in latitude 60°, when at 100° R. A. the milky way is in the east, it will at the same time be in the west at 280°; while in its meridional situation it will pass through *Cassiopeia* in the Zenith and through the constellation of the Cross in the Nadir.
- 323-4 Examination of the cluster in the Sword Handle of *Perseus*, with various space-penetrating powers.
- 825 [Beside the 863 gauges published in *P. T.*, 1785, p. 221, above 400 more have been taken in various parts of the heavens.]
- 326 The twenty-foot telescope cannot fathom the profundity of the milky way.

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- 1817 107 326 If the stars of the 5th, 6th, and 7th magnitudes cannot be supposed to be gradually of a smaller physical size and brightness than those of the 1st, 2d, and 3d, how much less can a supposition be admitted that would require that the stars, which, by a long series of gauging powers, have been proved to make their gradual telescopic appearance should also be gradually of a different construction with regard to physical size and brightness from those which we see with the naked eye?
- 327 The telescopic breadth of the milky way considerably exceeds the extent which, in our maps, is assigned to it.
- 328-30 Observations—sweeps—which confirm this.
- 330 X. *Concluding Remarks.*
What has been said of the extent and condition of the milky way in my papers on the construction of the heavens, with the addition of this attempt to give a more correct idea of its profundity in space, will nearly contain all the general knowledge we can ever have of this magnificent collection of stars.
- 331 Our sun with all the stars we can see with the eye are deeply immersed in the milky way, and form a component part of it.
- 1818 108 429 *Astronomical observations and experiments, selected for the purpose of ascertaining the relative distances of clusters of stars, and of investigating how far the power of our telescopes may be expected to reach into space when directed to ambiguous celestial objects.*
The method of equalization of star light will show the relative distances of stars; from this a method was explained in *P. T.*, 1817, by which means the profundity in space of every object consisting of stars can be ascertained as far as the light of the telescope suffices. This method may be used to ascertain the profundity of globular and other clusters.
- 430 I. *Of the distance of globular and other clusters of stars.*
General principles to guide in such observations.
- 431 II. *A series of observations of clusters of stars from which the order of their profundity in space is determined.*
- 431-51 Observations of H. vi, 7, 9, 10, 11, 12, 17, 20, 26, 35, 38, 41, 63, and of M. 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 19, 22, 30, 33, 34, 35, 53, 55, 56, 57, 62, 67, 68, 69, 71, 72, 74, 75, 77, 79, 80, 92, 97.
- 451 III. *Of a method to represent the profundity of celestial objects in space by a diagram.*

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1818 108 470 Fig. 1, Plate xxi, represents such a method applied to the foregoing objects.

460 IV. *Of ambiguous celestial objects.*

An object is often ambiguous when viewed with insufficient optical means, and its nature may be known by increasing this means. Objects ambiguous to the naked eye become known with the 20-feet telescope, and so on.

462 V. *The milky way, at the profundity beyond which the gauging powers of our instruments cannot reach, is not an ambiguous object.*

463 We may conclude that when our gauges will no longer resolve the milky way into stars it is not because it is ambiguous, but because it is fathomless.

463 VI. *Of the assumed semblance of clusters of stars when seen through telescopes that have not light and power sufficient to show their nature and construction.*

464 Observations of various clusters in telescopes of various sizes.

465 Two different principles, the *nebulous* and the *siderial*, have been observed in the celestial spaces.

Distinguishing characteristics of each.

466 It seems highly probable that some of the cometic, many of the planetary, and a considerable number of the stellar nebulae, are clusters of stars in disguise.

VII. *Of the extent of the power of our telescopes to reach into space when they are directed to ambiguous celestial objects.*

The method of equalizing the light of stars may be applied so as to give an estimate of the extent of this power.

When the united light of a cluster of stars is visible to the [naked] eye, there will be a certain maximum of distance to which the same cluster might be removed, so as still to remain visible in a telescope of a given space-penetrating power; and if the distance of the cluster can be ascertained by the gauging power of any instrument, that will just show the stars of it, the order of the profundity at which this cluster could still be seen as an ambiguous object may be ascertained by the space penetrating power of the telescope through which it is observed.

467-8 Examples of this method.

- Hevelius**: *Prodromus Astronomiæ*, 1690. [Has a catalogue of sixteen nebulae and clusters.]
- [———:] Discovered M. 40.
- Hind**: *A. N.*, xxiii, col. 356. [Discovery of nebula.]
- : *A. N.*, xxx, col. 257. [Discovery of nebula.]
- : *A. N.*, xxxv, col. 371. [Discovery of a variable nebula, $\alpha = 4^h 11^m 50^s$, $\delta = +19^\circ 8'$.]
- : *Mon. Not. R. A. S.*, x, p. 141. [Discovery of a nebula.]
- : *Mon. Not. R. A. S.*, xii, p. 208. [Notice of a new nebula discovered.]
- : [Variable nebula in *Taurus*.] *Mon. Not.*, xxiv, p. 65.
- : *C. R.*, 1850, i, p. 353. [Discovery of a nebula, $12^h 0^m 33^s + 66^\circ 0' 30''$. 1850.0.]
- : *Am. Jour. Sci.*, 2d series, xxxiii, p. 436. [Variable nebula in *Taurus*.]
- : *Nature* 1876, p. 545, [CHACORNAC's variable nebula.]
- Hinrichs**: *Am. Jour. Sci.*, 2d series, xxxix, pp. 40, 134, and 276. [Nebular hypothesis.]
- Hipparchus**: [Discovered G. C. 512, 521, 1681.] See SCHULTZ, *A. N.*, lxvii, col. 4.
- Holden**: Report Sec'y of the U. S. Navy, 1875, p. 75. [Report on TROUVÉLOT's drawings of nebulae.]
- : On the nebula of *Lyra* = M. 57. *Mon. Not. R. A. S.*, xxxvi, p. 61.
- : *Mon. Not.*, vol. xxxvii, p. 231. [List of Drawings of nebula of *Orion*.] See *A. N.*, lxxxix, col. 135.
- : On supposed changes in the nebula M. 17 = G. C. 4403, etc., [with plates.] *Am. Jour. Sci.*, 1876, May, vol. xi, page 341, 8d series.
- : On the proper motion of G. C. 4355. *Am. Jour. Sci.*, 1877, Dec.
- Homer**: *Odyssey*, lib. v, verse 270. [First mention of the *Pleiades*.]
- Hooke**: *Micrographia*, fol. London, 1665, p. 242. [Discovery of 4th and 5th stars in *Orion* trapezium?]
- Horner**: *Die Milchstrasse des südlich. Himmels u. die kapschen Wolken*. 1804. *ZACH. Monat. Corr.*, vol. 10, p. 220, [has a plate.]
- Hoseman**: *Discursus de viâ lacteâ*. 1665. 4°.
- Huggins**: A discourse on spectrum analysis applied to the heavenly bodies, 8°, Nottingham, 1866. [With photographs of drawings, etc., p. 29 *et seq.*] German translation by KLINKERFUES.

- Huggins**: On the spectrum of the great nebula in *Orion*. *Proc. R. S.*, xiv, p. 89.
- : *Proc. R. S.*, xv, 1866, p. 7. [Spectra of nebulae. Remarks.]
- : On the spectrum of the great nebula in *Orion*, etc. *Proc. R. S.*, vol. xx, 1872, p. 379.
- : On the motions of some of the nebulae towards or from the earth. [G. C. 1179, 4234, 4373, 4390, 4447, 4510, 4964.] *Proc. R. S.*, vol. xxii, 1873, p. 251. See *V. J. S.*, 1873, p. 218.
- : On the spectra of some of the nebulae. *P. T.*, 1864, p. 437. See *L. E. D. Phil. Mag.*, 1866, p. 523.
- : Further observations on the spectra of some of the nebulae, with a mode of determining the brightness of these bodies. *P. T.*, 1866, p. 381. See *L. E. D. Phil. Mag.*, 1866, p. 475.
- : Further observations of the spectra of the nebulae, etc. *P. T.*, 1868, p. 529. Abstract *Proc. R. S.*, xvi, p. 383.
- : See *L. E. D. Phil. Mag.*, [4,] xxxvi, p. 57, and *V. J. S.*, 1869, p. 116.
- : [Spectrum analysis applied to nebulae.] *Mon. Not. R. A. S.*, xxv, pp. 109, 112.
- : *Mon. Not. R. A. S.*, xxvi, p. 71. [Nine stars in trapezium of *Orion*.]
- : *Mon. Not. R. A. S.*, xxxii, p. 359. [Spectroscopic observations of nebulae.]
- : *Am. Jour. Sci.*, 2d series, xl, pp. 77–133. [Spectra of nebulae.]
- : *Am. Jour. Sci.*, 3d series, v, p. 75. [Spectra of nebulae.]
- : *Am. Jour. Sci.*, 3d series, viii, p. 75. [Motions of nebulae.]
- : *Les Mondes*, ix, 18. [Qu'est ce qu'une nébuleuse?]
- Humboldt**: *Cosmos*, iii and iv. [Bohn's edition, iii, milky way, etc.; iv, nebulae, etc.]
- Huth**: *Astron. phys. Beob. an Nebelflecken*. *B. J.*, 1807, p. 192.
- Huyghens**: *Systema Saturnium*, 4^o, 1659. [Has a drawing of nebula of *Orion*.]
- : See KAISER.

- Ideler**: *Ursprung d. Sternnamen*. 1809. 8vo., p. 262. [Contains SUFFR's account of Magellanic clouds.]
- : See under HERSCHEL various translations by IDELER.
- Ihle, A.**: [Discovered nebula G. C. 4424 = M. 22 in *Sagittarius*, 1665.] See KIRCH. *Ephemeriden*, 1682.

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—— : [*éloge of HUYGHENS.*] *Amsterd. Tijdsch v. Wiss. en. Nat. Wetens.* i, 1848, p. 7. [Contains a drawing of the nebula of *Orion* made by HUYGHENS in 1694, and left among his MSS.]

—— : *De Sterrenhemel*, vol. ii, plate 8, [gives drawings of nine nebulae, including nebula of *Orion*, G. C. 4403, 4447, 116?, 4532, 4230?] See pp. 538 and 542.

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—— : *Allgemeine Naturgeschichte und Theorie des Himmels.* Königsberg, 1755, 8vo, and *Sämmtliche Schriften*, band i, p. 207. [Abstract of this in *B. J.*, 1794, p. 226.]

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- Kepler**: *Dissertatio cum nuntio sidereo*, p. 39. [Belief that nebulae are clusters of stars.]
 ———: *Tabulae Rudolphinae*, 1627, p. 106, [and part ii, tables.]
 ———. *Epitome*, pp. 38 and 39. [Milky Way.]
- Key**: [45 H, iv, *Geminorum*.] *Mon. Not. R. A. S.*, xxviii, p. 154.
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- : *V. J. S.*, 1876, p. 78. [Personal differences in observations of nebulae.]
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- : *A. N.*, lxv., col. 315. [Remarks on variable nebulae, G. C. 1707, 4760.]
- : *A. N.*, lxvi, col. 47. [Remarks on errors in observation of M. 92, and h. 445.]
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- : *A. N.*, lxx, col. 135. [Corrections to HERSCHEL's *General Catalogue*.]
- : *A. N.*, lxxx, col. 21. [Micrometric observations of H. viii, 20 = 20 *Vulpeculæ*.]
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- : *Mon. Not. R. A. S.*, xxv, p. 153. [Spectrum of nebula of *Orion*.]
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- Senarmont**: *C. R.*, xlv, pp. 1075, 1294. [PORRO's new star in *Orion*.]
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<i>Vol.</i>	<i>Page.</i>	<i>Author.</i>
I	6	Mitchel.
I	15	Mitchel.
I	120-1	Mitchel.
II	10-85	Mitchel.

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- : *A. N.*, lxxviii, col. 295. [Observations of new nebulæ.]
- : *A. N.*, lxxix, col. 62. [Discovery and observations of new nebulæ.]
- : *A. N.*, lxxxi, col. 308. [Observations of new nebulæ.]
- : *A. N.*, lxxxiii, cols. 51 and 137. [Observations of new nebulæ.]
- : *A. N.*, lxxxix, col. 263. [Notice of 80 new nebulæ.]
- : *Mon. Not. R. A. S.*, xxxii, pp. 23–231. [Observations of new nebulæ.]
- : *Mon. Not. R. A. S.*, xxxiii, p. 433. [Observations of new nebulæ.]
- : *Mon. Not. R. A. S.*, xxxiv, p. 75. [New nebulæ.]
- : *C. R.*, vol. lxxiii, 1871, ii, p. 825. [Notice of discoveries—no catalogue given.]
- : *C. R.*, vol. lxxiv, 1872, i, p. 444. [Catalogue of new nebulæ.]
- : *C. R.*, vol. lxxvi, 1873, i, p. 1073. [Catalogue of new nebulæ.]
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- Stone, E. J., and Carpenter:** *Mon. Not. R. A. S.*, xxiv, p. 92. [On G. P. BOND's drawing of nebula of *Orion*. See same vol., p. 177.]
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——: *Mon. Not. R. A. S.*, xvii, p. 225. [Stars in nebula *Orionis*.]

——: [Nebula in *Taurus* (variable.)] *Mon. Not. R. A. S.*, xxii, p. 242.

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——: *M. M.*, iii, p. 550. [Variability of the *Orion* nebula.]

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——: *P. T.*, 1861, p. 738. [Measures of stars in the Dumb-bell nebula.]

——: *V. J. S.*, 1870, p. 25. [Review of ROSSE on Nebula of *Orion*.]

——: *V. J. S.*, 1870, p. 133.

——: *V. J. S.*, 1874, p. 64.

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———: *A. N.*, lxxxvi, col. 67. [*Merope* variable nebula.]

———: *A. N.*, xc, cols. 29, 33. [Remarks on observations of nebulae.]

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——: *Mon. Not. R. A. S.*, xix, p. 224. [Discovery of a new nebula, $8^h 21^m$; $+ 30^\circ 55'$.]

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De Vico: *Mem. Oss. Coll. Romano*, 1839, p. 31. [Remarks on nebulae and two plates of nebula of *Orion*—plates i and ii—also figure of trapezium with new stars.]

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——: *A. N.*, lxx, col. 161. [Places of 100 nebulae; 1865.0.]

——: *A. N.*, lxxi, col. 45. [Comparison of above places with D'ARREST's positions.]

——: *A. N.*, lxxviii, col. 245. [Spectra of nebulae G. C. 1179, 4230, 4234, 4373, 4360, 4447, 4510, 4532, 4572, 4628.]

——: *V. J. S.*, 1867, p. 193; 1874, p. 57; 1876, p. 276.

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- : Distribution of clusters and nebulae [with chart.] *Mon. Not. R. A. S.*, xxxiii, p. 558.
- Webb:** Celestial objects for common telescopes, 3d edition, London, 1873. 8vo. [Contains some original observations on nebulae not accessible elsewhere.]
- : *Mon. Not. R. A. S.*, xxvi, p. 208. [Notice of his drawing of Orion nebula.]
- : *Intellectual Observer*, vols. 2, 4, 5, 6, 7, 8, 9, 10, 11, and 12, [ditto. ditto.] Vol. 12, p. 258, has a history of the nebula of Orion.
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- : Positiones Mediæ Stellarum Fixarum, etc., [+ 15°, + 45°] preface by O. v. STRUVE. [Distribution of stars, milky way, etc.]
- Westminster Review:** Vol. xiv, p. 185. HERBERT SPENCER. Vol. xxv, p. 390.
- Winlock:** Astronomical engravings from Observatory of Harvard College, 35 plates, 1875. 4°. Collected in *Annals H. C. Obs'y*, vol. viii. [Contains plates by TROUVELOT of nebula *Orionis*, (2) G. C. 4447, nebula of *Andromeda*, G. C. 4250, G. C. 4294, G. C. 4332, G. C. 4355, etc.]
- : *Harv. Coll. Obs'y Annals*, viii, p. 53.
- Winnecke:** *V. J. S.*, 1872, p. 58.; 1875, p. 297, Ueber die Strassburger Beob. der Nebelflecke. [Observations; allusion is made to an unpublished series of observations with the Bonn heliometer in 1857–8.]
- : *V. J. S.*, 1877, p. 82. [120 different nebulae have been compared with one or more neighboring stars at Strassburg up to 1877.]
- : *A. N.*, xlv, col. 247. [Discovery of a nebula; remarks on suspected proper motions.]
- : *A. N.*, vol. li, col. 283, beilage zu No. 1224. [Observation of P. NOËL's on the star η *Argus*. See also the Amsterdam reprint of *Paris Mém.*, vol. 6, 1685–89.]
- : *A. N.*, lvii, col. 207. [HIND's variable nebula observed.]
- : *A. N.*, lix, col. 65. [Merope nebula and nebula No. 548, Bonn zone + 30°.]
- : *Mon. Not. R. A. S.*, xxiv, p. 7. [Nebula of Orion.]
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Zach's: *Correspondance Astronomique*, vol. xiv, p. 410.

——: *Monatliche Correspondenz*, vol. x, p. 220.

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II.

LIST OF THE MORE IMPORTANT BOOKS AND MEMOIRS RELATING TO THE NEBULA OF ORION.

[Arranged alphabetically by Authors.]

- Arago**: *C. R.*, xiii, p. 450. [Remarks on RONDONI's drawing.]
 ———: *C. R.*, xxvi, p. 50, [BOND's drawing.]
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- Barneby**: *Mon. Not. R. A. S.*, vol. xxxiv, p. 248. [Variability of 6th star in trapezium.]
- Bessel**: *B. J.*, 1808, p. 122. [CYSAT knew of the nebula of *Orion*.]
- Bode**: *Anleitung z. Kenntniss des Gestirnten Himmels*, p. 166, Plate 1, p. 556. [Two drawings.]
 ———: *Himmelskarten*, Tafel 30. [Drawing.]
- Bond, G. P.**: *Annals Harvard College Observatory*, vol. v, 1867. [With two steel engravings and two charts.] 4°.
 ———: *Mon. Not. R. A. S.*, xxi, p. 203. [Spiral structure.]
- Bond, G. P. and W. C.**: *Mon. Not. R. A. S.*, xxiv, p. 177.
- Bond, W. C.**: Description of the nebula about θ *Orionis*. *Mem. Am. Ac. Arts and Sciences*, vol. iii, [1848,] p. 87. [With steel engraving.]
 ———: *Proc. Am. Ac. Arts and Sciences*, i, p. 325. [Observations.]
 ———: Same volume, p. 342. [Resolvability of nebula of *Orion*.] See also *Am. Jour. Sci.*, 2d series, iv, p. 427.
-
- Carpenter and Stone**: *Mon. Not. R. A. S.*, xxiv, p. 92. [On G. P. BOND's drawing.]
- Cassini, J. D.**: *De Cometa Anni 1652-3*. [Discovery of the 4th star in *Orion's* trapezium, etc.]
 ———: *Découverte de la lumière céleste qui parait dans le Zodiaque*. [Suspects nebula of *Orion* to be a star cluster.] See DELAMBRE. *Hist. de l'Astr. Mod.*, vol. ii, pp. 700, 709, 744.
- Cysat**: CYSAT, der erste Entdecker des *Orions*-Nebel. [1619.] [R. WOLF, 1853.]
 ———: *Mathemata astronomica de loco cometæ qui sub finem anni 1618*, etc,

D'Abbadie : *Mon. Not. R. A. S.*, xvii, p. 245. [PORRO's new star in trapezium.]

D'Arrest : *Undersøgelse over de nebulose Stjerner*, etc. 1872. 4°. [With drawing of the nebula and detailed memoir.]

—— : *A. N.*, lvii, col. 341.

—— : *A. N.*, lxx, col. 337. [Notice of LEFEBVRE's drawing.]

Dawes : *Mon. Not. R. A. S.*, viii, p. 31. [New star.]

Denning : *A. N.*, lxxx, col. 299. [Ten stars in and near trapezium.] See **SALTER**.

De Vico : *Mem. Oss. Coll. Romano*, 1839, p. 81, plates i and ii. [Drawing; new stars in trapezium.]

—— : Same, 1840-41, p. 22. [Plate by **RONDONI**.]

—— : *C. R.*, xiii, p. 449. [Note on **RONDONI**'s drawing.]

Doppelmayer : *Himmels-Karten*, Blatt. 26.

Engelmann, R. : *Messungen 90 Doppelsternen*, etc., p. 147. [Variability of stars.]

Faye : *C. R.*, vol. lx, 1865, i, p. 468. [Remarks on **SECCHI**'s observation of the spectrum of the nebula in *Orion*.]

Flaugergues : *C. T.*, 1802, [An xi,] p. 361. [Observations.]

—— : *Mem. de l'Institut*, i, [An vi,] 1798, p. 103.

Gill : *Mon. Not. R. A. S.*, xxvii, p. 315. [Stars within the trapezium of *Orion*.]

Goldschmidt : *A. N.*, lix, col. 31.

Hahn, Von : *B. J.*, 1797, p. 157; *B. J.*, 1799, p. 235.

Herschel, J. : *Results of Astronomical Observations at the Cape of Good Hope*, p. 25. [With a plate.]

—— : Account, etc., of the nebula of *Orion*. *Mem. R. A. S.*, vol. ii, p. 487. [With plates.]

—— : *Mem. R. A. S.*, vol. iii, p. 189. [Fifth star of the trapezium.] See also same vol., p. 187.

Herschel, Capt. J. : *Proc. R. S.*, vol. xvi, [1867-8,] pp. 417, 451. [Observations of spectrum.]

- Herschel, W. :** MSS. in possession of Royal Society, London. [Unpublished observations.]
- : refers to the nebula of *Orion* in *P. T.*, 1785, p. 258; 1789, p. 249; 1791, pp. 72, 75, 77; 1811, pp. 276, 320; 1814, p. 258.
- Holden :** *Mon. Not. R. A. S.*, vol. xxxvii, p. 231.
- : Washington Astronomical Obs., 1874, plate vi, fig. 4.
- Hooke :** *Micrographia*, London, 1665, p. 242. [Discovery of the 4th and 5th stars in trapezium.]
- Huggins :** On the spectrum of the great nebula in *Orion*. *Proc. R. S.*, xiv, 1864, p. 89.
- : Ditto, ditto. *Proc. R. S.*, xx, 1872, p. 379.
- : Ditto, ditto. *Proc. R. S.*, xxii, 1873, p. 251.
- : *Mon. Not. R. A. S.*, xxvi, p. 71. [Nine stars in trapezium.]
- : *Am. Jour. Sci.*, 3d series, v, p. 75.
- : *P. T.*, 1868, p. 541. [Spectrum.]
- Huyghens :** *Systema Saturnium*. 4°. 1659. [Drawing.] See KAISER.

- Kaiser, F. :** *Amster. Tijdsch. v. Wiss. en Nat. Wetens*, i, 1848, p. 7. [HUYGHEN'S drawing, 1694.]
- : *De Sterrenhemel*, vol. ii, plate 3, pp. 535, 542. [Original drawing.]

- Lalande :** *Astronomie*, i, p. 272. [With a figure, MAIRAN'S.]
- Lamont :** *Ueber die Nebelflecken*. Munich, 1837. 4°. [With a plate.]
- Laplace :** *Exposition de la Système du Monde*, p. 452. [Opinion that nebulae change.]
- Lassell, W. :** Observations of the nebula of *Orion*, etc. *Mem. R. A. S.*, xxiii, [1854,] p. 53. [Plate.]
- : *Proc. R. S.*, xvi, p. 322. [Measures of stars.]
- : *A. N.*, xxxv, col. 383.
- : *Mon. Not. R. A. S.*, xiv, p. 74.
- : *Mon. Not. R. A. S.*, xvii, p. 68. [Relative visibility of 5th and 6th star in trapezium.]
- : *Mon. Not. R. A. S.*, xxii, p. 164. [New star in trapezium.]
- : *Mon. Not. R. A. S.*, xxix, p. 165.
- Lefebvre :** ROZIER *Obs. sur la Physique*, xxii, 1783, p. 34. [With drawing.]

Legentil: Remarques sur les Etoiles nébuleuses. *Hist. de l'Ac. Roy. des Sciences*, 1759, p. 453, [with several figures.]

LeSueur: *Proc. R. S.*, xviii, pp. 1, 242. [Spectrum.]

——: *Proc. R. S.*, xix, p. 18. [Spectrum.]

LeVerrier: *C. R.*, vol. xlv, 1859, pp. 1074, 1293-5. [PORRO's new star in nebula of *Orion*.]

Liaponoff: See STRUVE.

——: *Mon. Not. R. A. S.*, vol. xxiii, p. 228. [Review of his memoir.]

Long: *Astronomy*, vol. i, p. 321, plate 67, fig. 96. [Observations and drawing.]

Mairan: *Traité de l'Aurore Boreale*, [p. 249; nebula *Orionis* varies in shape; date of PICARD's drawing given as 1673, March 20. MAIRAN's drawing, (fig. xxvii,) 1727-1733.]

Messier: Nébuleuse d'*Orion*. *Hist. de l'Acad. R. des Sciences*, 1771, pp. 435, 458. [Drawing.]

Nichol: *System of the world*, 1846, p. 55. [Lord ROSSE's observations.]

Pond: On an appearance hitherto unnoticed in the nebula of *Orion*. *Mem. R. A. S.*, iii, 1826, p. 93. [Recession of the nebula from the stars.] [See also same volume, p. 187, for an observation of J. HERSCHEL and RAMAGE on this point.]

Porro: *Mem. dell'Osserv. Coll. Romano*, 1856-7, p. 3. [Discovery of a new star in trapezium.]

——: *A. N.*, xlvi, col. 171. [Same.]

——: *C. R.*, xlv, p. 1031. [Same.]

Robinson: *Nature*, vol. xv, p. 292. [Note on the resolvability of the central part of nebula *Orionis*.]

Rondoni: See DEVICO.

Rosse*: Account of observations on nebula of *Orion*, 1848-1867, *P. T.*, 1868, part i, p. 57. [Plates.] For a review of this, see O. STRUVE in *V. J. S.*, 1870, p. 25.

——: *Mon. Not. R. A. S.*, xxix, p. 165.

* Fourth Earl of Rosse.

- Salter**: *A. N.*, lxxx, col. 299. [Ten stars in and near trapezium.]
- Schroeter**: *Aphroditographische Fragmente*, p. 248. [Has a chart and memoir.]
- : *Beyträge zu den neuesten astron. Entdeckungen*, vol. iii, p. 449. [With figures.]
- : *B. J.*, 1797, p. 198. [Observations.]
- : *B. J.*, 1801, p. 128. [Changes in nebula of *Orion*.]
- Secchi**: *Mem. dell'Oss. Coll. Romano*, 1852-55, p. 80, and Plate v. [Drawing.]
- : *Mem. dell'Oss. Coll. Romano*, 1856-7, p. 8. [New star in trapezium.]
- : *Bull. Meteor. d. Coll. Romano*, 1865, January.
- : *Acc. d. Nuovo Cimento*, serie 2^a, vol. v-vi, 1872, p. 20. [The solar Corona is brighter than the nebula of *Orion*.]
- : *Atti dell'Ac. d. N. Lincei*, Anno xxv, sess. iv, 1872, p. 49. [Spectrum.] See also, Anno vii, p. 88.
- : *Sulla grande nebulosa di Theta Orione*. 1868. 4°. *Mem. Ital. Soc. Firenze*, vol. i. [Memoir; drawing; spectrum.]
- : *A. N.*, xlv, col. 60. [Sketch of nebula of *Orion*.]
- : *Mon. Not. R. A. S.*, vol. xviii, p. 8.
- : *Mon. Not. R. A. S.*, xxv, p. 153. [Spectrum.]
- : *Mon. Not. R. A. S.*, vol. xxviii, p. 162; xxix, p. 165.
- : *C. R.*, xlv, p. 1279, and xlv, p. 170. [PORRO's new star.]
- : *C. R.*, lx, p. 543. [Spectrum.] See also p. 468.
- : *C. R.*, lxv, p. 63.
- : *C. R.*, lxvi, p. 643. 1868. [Spectrum, etc.]
- : *Sugli Spettri Prismatici*. *Mem.*, i, ii, iii.
- Senarmont**: *C. R.*, xlv, pp. 1075, 1294. [PORRO's new star.]
- Smith**: *Opticks*. 4°. [HUYGHENS' drawing.]
- Stone, E. J., and Carpenter**: *Mon. Not. R. A. S.*, xxiv, p. 92. [On G. P. BOND's drawing of nebula of *Orion*.]
- Struve, O.**: *Observations de la grande nébuleuse d'Orion, avec 4 planches*. *Mem. de l'Acad. Imp. des Sciences de St. Petersbourg*, tome v, No. 4, 1862. See *M. M.*, ii, p. 517. [Abstract of above memoir.]
- : *Bull. de la Classe Phys.-Math. de l'Acad. Imp. de St. Petersbourg* xvi, 1853, col. 113.
- : *M. M.*, iii, p. 535. [Observations at Malta.]
- : *M. M.*, iii, p. 550. [Variability of nebula of *Orion*.]
- : *Mon. Not. R. A. S.*, xvii, p. 225. [Stars.]

Struve, O.: *V. J. S.*, 1870, p. 25. [Review of the Memoir of Lord RossE.]

Struve, W.: Rapport sur les observations de LIAPONOFF sur la nébuleuse d'Orion. *Bull de la Classe Phys.-Math.*, vol. xii, p. 316, and *Mélanges Math.*, ii, p. 45.

———: *Catal. Nov. Stell. Duplic.*, 1827, p. xiv. [Discovery of 5th star in trapezium.]

Tompel: *A. N.*, lviii, col. 240. [Drawing.]

———: *A. N.*, lxxx, col. 29. [Trapezium.]

———: Unpublished drawing, made in 1876.

Tisserand: *Bull. Inter. Obs. Paris*, 1876, No. 119, also *C. R.*, lxxxi, April 17, p. 891.

Trouvelot: *Annals Harv. Coll. Obs'y*, vol. viii. [Drawing.]

———: *Wash. Ast. Obs.*, 1874, Appendix I, plate vi, fig. 4. [Drawing.]

Vico: See DE VICO.

Vogel, H. C.: *A. N.*, lxxviii, col. 245. [Spectrum.]

Von Hahn: *B. J.*, 1797, p. 157.

———: *B. J.*, 1799, p. 235.

Webb: *Intellectual Observer*, vol. xii, p. 258. [History.]

———: *Mon. Not. R. A. S.*, xxvi, p. 208. [Account of his drawings and observations.]

Winlock: *Astronomical Engravings from the Observatory of Harvard College*, plate 24. [Drawing of central part, by TROUVELOT.] See *Annals Harv. Coll. Obs.*, vol. viii.

Winnecke: *Mélanges Math.*, iii, p. 499, and *Bull. de l'Ac. Imp.*, vii, p. 18.

———: *Mon. Not. R. A. S.*, xxiv, p. 7. [New stars.]

Wolf, R.: J. B. CYSAT von Luzern, 1853.

———: *A. N.*, xxxviii, col. 109.

III.

LIST OF BOOKS AND MEMOIRS RELATING TO VARIABLE NEBULÆ.

[Arranged alphabetically by Authors.]

Abbott: *Mon. Not. R. A. S.*, xxv, 192; xxviii, 200; xxxi, 228, 230, 231; xxxii, 61. [Nebula in *Argo*.]

——: *Mon. Not. R. S. Tasmania*; 1870, p. 21; 1871, p. 17; 1872, p. 27. [Same.]

Airy: *Mon. Not. R. A. S.*, xxxi, p. 233. [Same.]

Auwers: *A. N.*, lviii, col. 861. [On the variability of No. 548, Bonn zone + 80°.]

——: *Mon. Not. R. A. S.*, xxii, p. 150. [HIND's missing nebula of 1852.]

Bredichin: *Annales de l'Observatoire de Moscou*, ii, p. 125. [TEMPEL's nebula in the *Pleiades*.]

Bulliadus: *P. T.*, 1667, p. 459; *p. t.*, i, p. 162. [The nebula of *Andromeda* became invisible to the naked eye in February and March, 1667.]

Burton: *Mon. Not. R. A. S.*, xxxvi, p. 69. [Nebula in *Argo*.]

Butillon: *C. R.*, 1848, xxvii, pp. 112, 188. [Proper motion of M. 92.]

Cassini: *Elémens d'Astronomie*, 1740, 4°, p. 77. [*Andromeda* nebula.]

Chacornac: *Bull. Inter. de l'Obs. de Paris*, 1863, April 28. [1191 h.]

——: Nébuleuse variable de ξ *Taureau*. *C. R.*, lvi, 1863, p. 637.

——: *National Almanac*, [U. S.], 8vo, 1864, p. 36. [Notice of discovery of his variable nebula.]

——: *Mon. Not. R. A. S.*, xxii, p. 277. [Missing nebula in *Coma Berenices*.]

D'Arrest: *A. N.*, xlii, col. 193.

——: *A. N.*, lvi, col. 328. [HIND's variable nebula.]

——: *A. N.*, lvii, col. 337. [HIND's variable nebula and others.]

——: *A. N.*, lviii, col. 155. [Discovery of a second variable nebula in *Taurus*.]

——: *A. N.*, lix, col. 13. [*Merope* nebula.]

——: *A. N.*, lx, col. 377. [On CHACORNAC's variable nebula near ϵ *Tauri*.]

——: *A. N.*, lxiv, col. 125. [Disappearance of a nebula.]

——: *A. N.*, lxviii, col. 251. [Three missing nebulae.]

——: *A. N.*, lxxi, col. 143. [HIND's variable nebula.]

——: *A. N.*, lxxix, col. 193. [Changes in spectrum of H. iv, 37.]

Dreyer: *V. J. S.*, 1876, p. 269. [*Merope* nebula not seen in Lord ROSSE's telescopes.] See ROSSE in *Nature*, vol. xv, p. 897.

Ellery: *Mon. Not. R. A. S.*, xxxiv, p. 269. [Nebula in *Argo*.]

Engelmann, R.: *Messungen 90 Doppelsternen, etc.*, p. 147. [Variability of stars in nebula *Orionis*.]

Gould: *Mon. Not. R. A. S.*, xxxii, p. 178. [Nebula in *Argo*.]

Hall, Maxwell: *Nature*, 1877, p. 244, [Jan. 11.] [*Merope* nebula.]

Herschel, J.: *Mon. Not. R. A. S.*, xxii, p. 248. [Missing nebula in *Coma Berenices*.]

——: *Mon. Not. R. A. S.*, xxviii, p. 225; xxix, pp. 82, 164, 228. [Nebula in *Argo*.]

——: *The General Catalogue of Nebulae and Clusters of Stars*, P. T., 1864, has [pp. 14-40] notes on various nebulae, from which the following in regard to variable nebulae has been extracted. A few additions have been made from other sources:

I. Variable nebulae, [*brightness*].—G. C. 768, [TEMPEL]; 839, [HIND]; 1792; 2197?? [*η Argus*]; 2211, [VOGEL]; 2319; 2405; 3079; 3254; 3311; 3858??; 3977; 4016; 4173?; 4415, [TUTTLE]; 4473, [HIND]; 4922.

II. Variable nebulae, [*proper motion*].—G. C. 2501; 3138, 3588. 4051-2 binary? See ROSSE, *P. T.*, 1861, p. 704. G. C. 4403??, G. C. 4355, [HOLDEN.]

III. Variable nebulae, [*possible comets*].—G. C. 573, 614, 1696, 2094, 2846, 3550.

Herschel, Capt. J.: *Mon. Not. R. A. S.*, vol. xxix, p. 82; xxxi, p. 235. [Nebula in *Argo*.]

Hind: *Am. Jour. Sci.*, 2d series, xxxiii, p. 436. [His variable nebula in *Taurus*.]

——: *Nature*, 1876, Oct. 19, p. 545. [CHACORNAC's variable nebula.]

——: *Mon. Not. R. A. S.*, xxiv, p. 65. [Variable nebula in *Taurus*.]

——: *A. N.*, xxxv, col. 371. [Discovery of a variable nebula, $\alpha = 4^h 11^m 50^s$; $\delta = +19^\circ 8'$.]

——: *Nature*, 1876, p. 545. [CHACORNAC's variable nebula.]

Holden: On supposed changes in M. 17 = G. C. 4403. *Am. Jour. Sci.*, 8d series, xi, p. 341.

——: On the proper motion of G. C. 4355. *Am. Jour. Sci.*, 1877, Dec.

Key: [45, H. iv, *Geminorum*.] *Mon. Not. R. A. S.*, xxviii, p. 164.

Knott: [45, H. iv, *Geminorum*.] *Mon. Not. R. A. S.*, xxv, pp. 62, 191.

Le Sueur: *Scientific Opinion*, vol. iii, p. 250. [Nebula in *Argo*.]

——: *Trans. R. S. Victoria*, x, pp. 11-23. [Nebula in *Argo*.]

Le Verrier: *C. R.*, vol. liv, 1862; p. 299. [HIND's variable nebula.]

Mairan: *Traité de l'Aurore Boréale*, p. 248. [Nebula of *Orion* varies in shape.]

McGeorge: *Proc. R. S. Victoria*, x, pp. 71, 106. [η *Argús*.]

Melbourne Obs'y: Report of Board of Visitors, 1875. [η *Argús*.]

Petersen: *Ast. Jour.*, i, p. 47. [HIND's nebula.]

Pogson: *Mon. Not. R. A. S.*, xxi, p. 82. [Changes in 80 M.]

Pons and De Zach: *Corres. Astron.*, vol. xiv, p. 410. [Changes in nebulae.]

Powell, E. B.: *Mon. Not. R. A. S.*, xxiv, p. 171. [Nebula in *Argo*.]

Proctor: *Mon. Not. R. A. S.*, xxxiii, p. 14. [Nebula in *Argo*.]

Robinson: *B. A. A. S.*, 1869, p. 20; *Nature*, vol. vi, p. 8. [Nebula in *Argo*.]

Rosse: *Nature*, vol. xv, [1877,] p. 897. [TEMPEL's variable nebula near *Merope*.]

Russell: Observations on the stars and nebula about η *Argus*. 8vo. Sydney, 1871.

——: *Mon. Not. R. A. S.*, xxxii, p. 22. [Nebula in *Argo*.]

Schmidt, J. F.: *A. N.*, lv, col. 91. [New variable nebula.]

——: *A. N.*, lvii, col. 243. [Variability of No. 6 Bonn zones and HIND's variable nebula.]

——: *A. N.*, lviii, col. 253. [TEMPEL's variable nebula.]

——: *A. N.*, lxv, col. 261. [M. 8 contains a variable star.]

——: *A. N.*, lxxviii, col. 199. [*S. Coronæ* nebulous?]

——: *A. N.*, lxxxviii, col. 283. [Connection of variable stars with nebulæ.]

Schroeter: *B. J.*, 1801, p. 128. [Announces changes in nebulæ of *Orion* and *Lyra*.]

Schönfeld: *A. N.*, lviii, col. 355. [On variability of nebula No. 548 Bonn zone + 30°.]

Schultz: *A. N.*, lxv, col. 315. [Remarks on variable nebulæ. G. C. 1707, 4760]

Severn: *Mon. Not. R. A. S.*, xxx, p. 180. [Nebula in *Argo*.]

Struve, O.: *M. M.*, iii, p. 550. [Variability of *Orion* nebula.]

——: *Mon. Not. R. A. S.*, xxii, p. 242. [Nebula in *Taurus*.]

Trouvelot: TEMPEL's variable nebula near *Merope*. [Unpublished paper read to *Am. Ac. A. and S.*, in 1876.]

Tebbutt: *Mon. Not. R. A. S.*, xxxi, p. 210. [Nebula in *Argo*.]

Tempel: *A. N.*, liv, col. 286. [Discovery of a variable nebula.]

——: *A. N.*, lxxxvi, col. 67. [*Merope* variable nebula.]

——: *A. N.*, xc, col. 355. [On 8 MESSIER.]

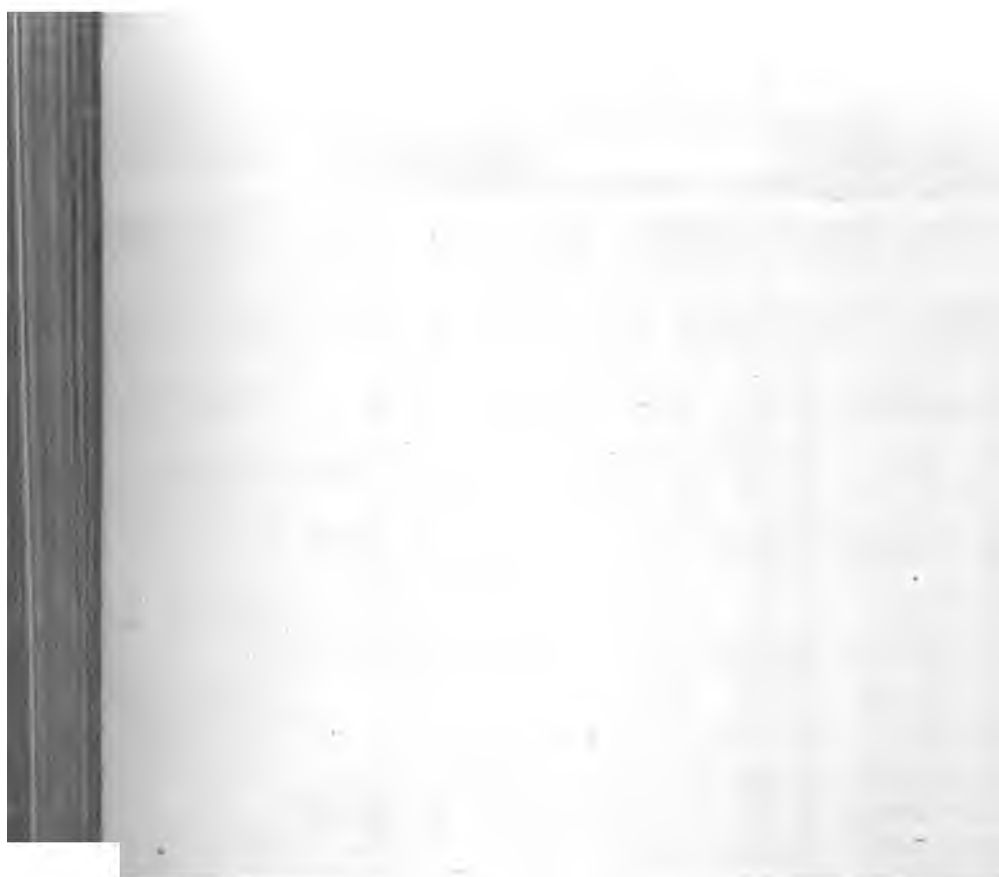
——: *Pub. del R. Oss. Milano*, No. 5, plate ii. [*Merope* variable nebula.]

Winnecke: *A. N.*, li, col. 383. [Noël's observation of η *Argús*.]

——: *A. N.*, lvii, col. 207. [Hind's variable nebula.]

——: *A. N.*, lix, col. 65. [*Merope* nebula and nebula No. 548 Bonn zone + 80°.]

Wolf, C.: *C. R.*, 1875, July 5, vol. lxxxi, p. 29. [Temper's variable nebula.]



IV.

LIST OF FIGURED NEBULÆ.

A large portion of the following list of drawings of nebulæ is taken from Sir JOHN HERSCHEL's "General Catalogue of Nebulæ and Clusters of Stars," p. 40, *Phil. Trans.*, 1864, part i. It has been attempted *first* to correct his list, which as printed, contains many errors,* and *second* to bring it up to the present time as far as possible. In an attempt of this kind there are necessarily many omissions, and the writer solicits corrections and additions to the list. By the courtesy of Mr. LASSELL, Mr. E. B. KNOBEL, Dr. H. C. VOGEL, Mr. ELLERY, Rev. T. W. WEBB, Dr. DOBERCK and others, I have been able to include in this list a reference to some important drawings which are not yet "published;" in particular a long and valuable series of photographs of star-clusters by Dr. RUTHERFURD, which I have given separately, as well as a great number of southern star-clusters photographed by Dr. B. A. GOULD, and a list of drawings by M. TROUVELOT.

The references to the works cited are given below: it is to be noted that the drawings of DUNLOP are omitted for reasons given by Sir JOHN HERSCHEL, (*op. cit.*, p. 40,) as are those in the *Philosophical Transactions*, by Sir WM. HERSCHEL. For similar reason the drawings in SMYTH's *Celestial Cycle* are omitted.

* In HERSCHEL's list the references to his drawings of 1833 are to the plates in his own paper, beginning with plate i. In the *Phil. Trans.* for 1833, HERSCHEL's plate i. is plate ix. I have, however, seen a separate copy of this paper in which the steel plates were numbered from i. on; it has seemed best to refer to them as they stand in the complete volumes.

LIST OF ABBREVIATIONS EMPLOYED.

<i>Abbreviations.</i>	<i>Works Cited.</i>	<i>Authors.</i>
P. T., 33.	Philosophical Transactions, 1833-----	J. HERSCHEL.
P. T., 44.	" " 1844-----	LORD ROSSE.
P. T., 50.	" " 1850-----	"
P. T., 61.	" " 1861-----	"
P. T., 68.	" " 1868-----	"
C. G. II.	Results of Astronomical Observations at the Cape of Good Hope.	J. HERSCHEL.
R. di.	Wood-cut diagrams in P. T., 61. [Only those are referred to which express some feature not elsewhere depicted by the author.]	LORD ROSSE.
B. A. A.	{ American Academy Arts and Sciences, vol. iii, n. s. }	W. C. BOND. G. P. BOND.
M. A. A.	{ Transactions American Philosophical Society, vol. vii. }	MASON and SMITH.
D'Arr.	De instrumento magno æquetoreo, etc. 1861.	D'ARREST.
D'Arr. ²	Sid. Nebul. Obs. Havnienses, 1867 -----	"
D'Arr. ³	Undersøgelse over de nebulose Stjerner, etc.	"
Lam.	Vorlesung u. die Nebelflecken, 1837-----	LAMONT.
Lam. ²	Ann d. k. k. Stw. b. München, vol. xvii. --	"
Secchi.	Mem. dell'Oss. Coll. Romano, 1852-55, etc.---	SECCHI.
Lass.	Memoirs R. A. S., vol. xxiii-----	LASSELL.
Lass. ²	" " " xxxvi-----	"
Lass. ³	Lithographs privately distributed. <i>Mon. Not. R. A. S.</i> , vol. xxi, p. 52.	"
Lass. ⁴	Drawings unpublished, but kindly communicated by the author.	"
H. C.	{ Astronomical Engravings from the Observatory of Harvard College. }	WINLOCK and TROUVELOT.
Washington.	Washington Ast. Obs., 1874, Appendix I.--- }	HOLDEN and TROUVELOT.
Vogel.	{ Beob. von Nebelflecken. Leipzig, 1867. A few copies of this work contained photographs. }	H. C. VOGEL.
Vogel. ²	Leipzig Observations, vol. i, 1876-----	"
Vogel. ³	Bothkamp Observations, vol. iv, 1877-----	"

LIST OF ABBREVIATIONS—*Continued.*

<i>Abbreviations.</i>	<i>Works Cited.</i>	<i>Authors.</i>
Knobel.	{ Drawings mostly of clusters, as yet unpublished, but kindly communicated by the author. }	KNOBEL
Melbourne	{ Astronomical observations at Melbourne, yet unpublished, but kindly communicated by R. J. L. ELLERY, esquire. }	ELLERY. TURNER. McGEORGE.
Le Sueur.	Proc. R. S., 1870 -----	LE SUEUR.
Trouvelot.	{ Drawings of nebulae, as yet unpublished, but kindly communicated by the author. }	TROUVELOT.

LIST OF FIGURED NEBULÆ.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
27	C. G. H.	IV	8	Melbourne.	
31	P. T., 61.	XXV	1		
52	C. G. H.	III	1		
67	C. G. H.	VI	19	Melbourne.	
105-6	} B. A. A. Messier.	Opp. p. 86	-----	-----	<i>Andromeda.</i>
116-7		Opp. p. 213	-----	-----	Hist. de l'Ac. R. des Sciences, 1806.
		Rondoni.	-----	-----	Meth. dell'Oss. Coll. Romano, 1840-1.
	H. C.	XXXIII			
128	P. T., 33.	XIV	52		
	Lass. ²	I	1		
169	C. G. H.	V	10	Melbourne.	
187	C. G. H.	IV	6	Melbourne.	
298	P. T., 33.	XIII	88		
303	R. di.				
352	P. T., 50.	XXXVI	5		
	P. T., 61.	XXVI	10		
	Vogel. ³	XIV			
372	R. di.	-----	-----	Knobel.	
400	P. T., 33.	XIV	58		
412	P. T., 61.	XXV	2		
521	Krueger.	I	-----	-----	Fenn. Soc. Sci. Acta, vol 8, p. 55.
527	P. T., 33.	X	23		
	R. di.				
544	D'Arr.	II	7		
560	P. T., 61.	XXV	3		
567	C. G. H.	VI	14	Melbourne.	
572	P. T., 61.	XXV	4		
575	P. T., 33.	XIV	56	Trouvelot.	
	P. T., 61.	XXV	5		
584	Pihl.	I	-----	Knobel.	Mon. Not. R. A. S., vol. 28, p. 247, and vol. 29, p. 329. -
600	P. T., 61.	XXV	6		
	Lass. ²	I	2		
604	Lass. ²	I	3		
705	C. G. H.	VI	17	Melbourne.	
709		-----	-----	Melbourne.	
731	C. G. H.	IV	1	Melbourne.	
768	Tempel.	II	-----	-----	Pub. del R. Oss. Milano No. 5. Var.
810	P. T., 33.	X	81		
	P. T., 61.	XXV	7		
822	C. G. H.	V	11	Melbourne.	
823	C. G. H.	V	11	Melbourne.	

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
826	D'Arr.	II	9		
	Lass.	II	4		
	Lass. ²	I	4		
853	P. T., 61.	XXV	8		
888	P. T., 61.	XXV	9	Melbourne.	
905	Vogel. ²	II			
979	C. G. H.	III	8	Melbourne.	
980	C. G. H.	III	8		
981	C. G. H.	III	8		
987	C. G. H.	III	8		
1057	C. G. H.	VI	11	Melbourne.	
1082	C. G. H.	III	6		
1084	C. G. H.	III	6		
1085	C. G. H.	III	6		
1086	C. G. H.	III	6		
1089	C. G. H.	III	6		
1090	C. G. H.	III	6		
1119				Knobel.	
1135	C. G. H.	III	2		
1137	P. T., 33.	XIII	49		
	Vogel. ³	14			
1140	C. G. H.	III	2		
1141	C. G. H.	III	2		
1142	C. G. H.	III	2		
1143	C. G. H.	III	2		
1156	C. G. H.	IV	7	Melbourne.	
1157	P. T., 33.	XVI	81		
	Lass. ²	II	6		
	Vogel. ³	14			
	P. T., 44.	XVIII	81		
	R. di.				
	D'Arr.	II	4		
	Secchi.	IV	8		
	Lass.	II	1		
	Vogel.	I	1		
1163	C. G. H.	IV	7		
1164	C. G. H.	IV	7		
1165	C. G. H.	VI	20	Melbourne.	
1168	C. G. H.	VI	20		
1171	C. G. H.	VI	20		
1174	C. G. H.	IV	7		
1175	C. G. H.	VI	20		
1176	C. G. H.	IV	7		
1177	C. G. H.	IV	7		

LIST OF FIGURED NEBULÆ—Continued.

DRAWINGS OF THE NEBULA OF ORION = G. C. 1179.

<i>Observer.</i>	<i>Date.</i>	<i>Place where Published.</i>
Huyghens.	1656	Systema Saturnium, p. 8.
Picard.	1673	Hist. de l'Acad. Royale des Sciences, 1759, p. 470, fig. 5. <i>Date</i> from <i>Traité de l'Aurore Boréale</i> , [Mairan,] p. 248.
Huyghens.	1694	Amsterdam Tijdsch. v. Wiss. en Nat. Wetens., vol. i, 1848.
Mairan.	1731	Traité de l'Aurore Boréale, p. 248.
Long.	1742	Astronomy, p. 321, plate 67, fig. 96.
LeGentil.	1758	Hist. de l'Acad. R. des Sci., 1759, p. 470, figs. 2 and 6.
Messier.	1771	Hist. de l'Acad. R. des Sci., 1771, p. 460.
W. Herschel.	1774	Phil. Trans., 1811, p. 320. [Unpublished description and observations in Ms. in possession of the Royal Society, London.]
Lefebvre.	1779	Obs. sur la Physique, vol. xxii, p. 34, fig. 8, plate i.
Schröter.	1794	Aphroditographische Fragmente, p. 248.
Schröter.	1797-8	Beiträge z. d. neuesten Astron. Entdeck. iii, p. 149, [4 figures.]
Bode.	?	Anleit. z. Kenntniss d. Gest. Himmels, p. 166, and plate 1. [See also Himmelskarten, Tafel 30.]
J. Herschel.	1824	Mem. R. A. S., vol. ii, 1826, p. 487.
J. Herschel.	1837	Obs. Cape of Good Hope, p. 25, plate viii.
Lamont.	1837	Ueber d. Nebelflecken, p. 29, fig. xi. [A pencil original of this is in the possession of Col. COOPER, of Markree; dated February, 1839.]
DeVico.	1839	Mem. Oss. Coll. Romano, 1839, plates i and ii.
Rondoni.	1841	Mem. Oss. Coll. Romano, 1841, p. 24.
Lassell.	1847	Nichol's Architecture of the Heavens. [Separate copies of this were printed.] p. 106, plate x.
W. C. Bond.	1848	Mem. Amer. Acad'y, iii, p. 87. A revised copy of this drawing is given in <i>Annals Harv. Coll. Obs'y</i> , vol. v., p. 174; and this is probably the most authentic.
Liaponoff.	{ 1847 }	Mem. Imp. Ac. de St. Petersbourg, vol. v, 1862.
Struve.	{ 1851 }	
Lassell.	1854	Mem. R. A. S., xxiii, p. 53, plate i.
Secchi.	1862	Ast. Nach., vol. xlv, col. 60.
Tempel.	1862	Ast. Nach., vol. lviii, col. 240.
G. P. Bond.	1865	Annals Harv. Coll. Obs'y, vol. v, plate i. [Reprinted in <i>Ast. Engravings Harv. Coll. Obs'y</i> , 1874. See <i>Annals H. C. Obs'y</i> , vol. viii.]
Rosse.	1867	Phil. Trans., 1868, p. 57.
Secchi.	1868	Firenze Ital. Soc. Mem., 8d ser., i, part 2.
D'Arrest.	1872	Undersøgelse over de neb. Stjerner. 1874.
Winlock.	1874	{ Ast. Engravings from H. C. Obs'y. Annals Harv. Coll. Obs'y, vol. viii.
Trouvelot.		
Holden.	1876	Wash. Ast. Obs., 1874, Appendix I, plate vi, fig. 4.
Trouvelot.		

LIST OF FIGURED NEBULÆ—Continued.
NEBULA OF ORION—*Unpublished Drawings.*

Observer.	Date.	Place where reference is to be found.
Flaugergues.	1802	In <i>C. T.</i> , 1802, [an xi,] p. 862, it is noted that such a drawing was deposited with the <i>Bureau des Longitudes</i> .
Pond.	1826	In <i>Mem. R. A. S.</i> , iii, p. 94, it is noted that such a drawing was to be sent to the Royal Astron. Soc. Made at Naples? Letter of Dr. C. H. F. Peters.
Cooper.	1847?	Oil painting made at Starfield, and now in possession of the Royal Ast. Soc'y. [A copy of this is at the residence of Mr. Lassell, Ray Lodge, Maidenhead.]
Lassell.	1847	
Lassell. } Hippesley. }	1854	{ Oil painting in possession of Royal Astronomical Society; copied in <i>Mem. R. A. S.</i> , vol. xxiii.
Schmidt.	1860-75	2 drawings; another is [1877] in progress.
Lassell.	1862	See Proc. R. S., vol. xvi, p. 322.
Webb.	1863	See Mon. Not. R. A. S., vol. xxvi, p. 208.
Webb.	1866	Kindly communicated by the author.
Bird.	1866	Kindly communicated by the Rev. T. W. Webb.
Tempel.	1876	Part of an unpublished series of Drawings of nebula. A copy of this is in possession of the Royal Astronomical Society.

G. C. No.	Work Cited.	Plate.	Fig.	Unpublished drawings.	Remarks.
1180	C. G. H.	II	3		
1183	C. G. H.	II	3		
	P. T., 50.	XXXVIII	16		
	Lass.	II	3		
1185	C. G. H.	VIII	1		
	B. A. A.	Opp. p. 96.			
	Lass.	I	1		
1225	D'Arr.	II	2		
	Lass. ²	I	8		
	Secchi.	IV	12		
	Lass.	II	2		
1226	D'Arr.	II	10		
1233	C. G. H.	III	5		
1235	C. G. H.	III	5		
1238	C. G. H.	III	5		
1243	C. G. H.	III	5		
1248	C. G. H.	IV	9	Melbourne.	
1249	C. G. H.	IV	9		
1258	C. G. H.	IV	9		
1259	C. G. H.	IV	9		
1260	C. G. H.	IV	9		
1265	C. G. H.	IV	9		
1266	C. G. H.	IV	9		
1267	P. T., 38.	XII	36		
	R. di.				

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>		
1269	C. G. H.	II	4	Melbourne.	Two figures.		
1276	C. G. H.	III	4				
1277	C. G. H.	III	4				
1278	C. G. H.	III	4				
1279	C. G. H.	III	4				
1281	C. G. H.	III	4				
1282	C. G. H.	III	4				
1283	C. G. H.	III	4				
1361	Vogel. ²	II					
1419	R. di.						
1425	P. T., 61.	XXVII	11	Melbourne.	Proc. R.S., xix, p. 19.		
	Vogel. ²	I	1				
1437	P. T., 33.	XIV	64				
	P. T., 50.	XXXVII	10				
	Secchi.	IV	6				
	Lass.	II	8				
	Vogel.	XVI	2				
1467	P. T., 33.	XVI	91				
1477	P. T., 61.	XXVII	12				
1477-8	Le Sueur.						
1511	C. G. H.	IV	4	Melbourne.	Mon. Not. R. A. S., xxviii, p. 155.		
	Lass. ²	II	9				
1519	P. T., 33.	XV	72				
	P. T., 50.	XXXVII	6				
	Lass. ²	I	10				
	Secchi.	IV	15				
1519 }	Lass.	II	9				
1520 }							
1532	P. T., 50.	XXXVIII	15				
	Lass.	II	6				
	Lass. ²	I	11				
	H. C. Key.						
	Secchi.	IV	18	Melbourne.			
	Vogel.	I	8				
1565	P. T., 50.	XXXVIII	12				
	Secchi.	IV	11				
	Lass.	II	5				
1567	Lass.	II	7				
	Secchi.	IV	14				
1677	C. G. H.	VI	12				
1677 ?							
1721	P. T., 33.	XIV	61		Melbourne.		
	Lam.	I	8				
1728	P. T., 33.	XIV	65				
1745	C. G. H.	V	12				
1801	C. G. H.	V	8				
1861 }	P. T., 33.	XV	70				
1863 }							
	Lass. ²	II	12				
	Vogel.	I	4				

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
1950				Knobel.	
2008	C. G. H.	V	9		
2017	C. G. H.	VI	9		
	Lass.	II	10	Melbourne.	
	Lass. ²	III	18		
	Secchi.	IV	16		
2053	P. T., 50.	XXXVI	8		
	P. T., 61.	XXVII	13	Melbourne.	
2058	P. T., 61.	XXVII	14		
2063	C. G. H.	VI	2	Melbourne.	
2067	C. G. H.	IV	3	Melbourne.	
2102	C. G. H.	VI	5		
	Lass.	II	11	Melbourne.	
	Lass. ²	III	14		
	Secchi.	IV	5		
2158	P. T., 83.	XIII	40		
2197	C. G. H.	IX	1	Melbourne.	<i>η Argus</i> . Many small figures of this exist which are not here recorded.
	McGeorge.				Trans. R. S. Victoria, vol. x, p. 110, figs. 1-6.
2216	P. T., 61.	XXVII	15		
2217	P. T., 61.	XXVII	15		
2338	C. G. H.	IV	10	Melbourne.	
2336	C. G. H.	IV	10		
2337	C. G. H.	IV	10		
2338	C. G. H.	IV	10		
2340	C. G. H.	IV	10		
2342	C. G. H.	IV	10		
2343	P. T., 83.	X	32		
	P. T., 50.	XXXVII	11		
2847	Vogel ²	I	2		
2873	P. T., 83.	XIV	53		
	P. T., 50.	XXXVII	7		
	Lass. ²	III	15		
	Vogel. ²	I	4		
	Lam.	I	6		
2377	P. T., 83.	XIV	54		
	P. T., 61.	XXVII	16		
	Vogel. ²	I	5		
2378	P. T., 83.	XIV	51		
	Vogel. ²	I	8		
2379	R. di.				
2445	R. di.				
2486	P. T., 83.	XV	79		
2488	P. T., 83.	XV	79		
2559	R. di.				
2581				Melbourne.	

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
2597	R. di.				
2606	P. T., 61.	XXVII	17		
2670	P. T., 61.	XXVII	18		
2671	P. T., 61.	XXVII	18		
2680	P. T., 61.	XXVII	19		
2733	R. di.				
2756	P. T., 61.	XXVII	20		
2760	P. T., 61.	XXVII	20		
2804	P. T., 33.	XV	71		G. C. No. 2786; Vogel ² , plate i, fig 6.
2806	P. T., 33.	XIV	59		
	Vogel. ²	I	7		
2807	P. T., 50.	XXXVII	8		
2838	P. T., 50.	XXXV	2		
	Lass. ²	IV	16		
	Vogel. ²	I	8		
2841	P. T., 33.	XIV	55		
2870	P. T., 61.	XXVII	21		
2878	P. T., 33.	XV	69		
2884	P. T., 61.	XXVII	21		
2890	Lass. ²	III	17		
2910	P. T., 33.	XIV	57		
2950	P. T., 61.	XXVII	22		
2958	P. T., 33.	XV	68		
2962	P. T., 33.	XV	68		
2972	R. di.				
3025	Lass. ²	IV	19		
3028	Lass. ²	IV	18		
3041	P. T., 61.	XXVII	23		
3042	P. T., 61.	XXVII	23		
3049	Lass. ²	IV	20		
	Vogel. ²	I	9		
3085	P. T., 61.	XXVIII	24		
3101	P. T., 33.	XVI	83		
3106	P. T., 33.	XII	37		
	Lass. ²	V	21		
3108	P. T., 33.	XV	78		
3109	P. T., 33.	XV	78		
3113	P. T., 33.	XIV	66		
3132	P. T., 33.	XIV	50		
	Lass. ²	V	22		
3151	P. T., 61.	XXVIII	25		
3152	P. T., 61.	XXVIII	25		
3155	Lass. ²	V	23		
3165	P. T., 33.	XV	76		
	P. T., 50.	XXXVII	9		
3167	Lass. ²	V	24		
3178				Melbourne.	
3180	P. T., 33.	XV	74		
3182	P. T., 33.	XV	74		
3183				Melbourne.	
3189	P. T., 33.	XV	75		

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
3190	P. T., 61.	XXVIII	26		
3240	P. T., 61.	XXVIII	27		
3249	R. di.				
3258	P. T., 33.	XIII	41		
	Lass. ²	V	25		
3275	C. G. H.	I	2		
3278	P. T., 33.	XVI	84		
3321	P. T., 33.	X	27		
	Lass. ²	VI	26		
3340	P. T., 33.	XIV	62		
3342	Vogel. ²	I	10		
3356	P. T., 33.	XIV	67		
3511	P. T., 61.	XXVIII	28		
3525	C. G. H.	IV	2	Melbourne.	
3531	C. G. H.	V	7		
3570	C. G. H.	VI	1		
	Le Sueur.	I		Melbourne.	
3572	P. T., 33.	X	25		
	P. T., 50.	XXXV	1		
	Lass. ²	VI	27		
	Vogel.	I	5		
	R. di.				
3606	C. G. H.	IV	5		
	Lass. ²	VII	28	Melbourne.	
3607				Melbourne.	
3614	P. T., 33.	XIII	39		
	Lass. ²	VII	29		
3615	P. T., 61.	XXVIII	29		
	Vogel. ²	I	11		
3651	C. G. H.	VI	15		
3661 ?				Melbourne.	
3706	C. G. H.	VI	10	Melbourne.	
3717	P. T., 61.	XXVIII	30		
3750	R. di.				
3766	P. T., 61.	XXIX	35		
3770	P. T., 61.	XXIX	35		
3778	P. T., 61.	XXIX	35		
3779	P. T., 61.	XXIX	35		
3928				Melbourne.	
4040	Vogel. ²	II			
4051 }	P. T., 33.	XV	77		
4052 }					
	P. T., 61.	XXVIII	31		
4058	P. T., 50.	XXXVII	8	Trouvelot.	
4066	C. G. H.	VI	8	Melbourne.	
4083	P. T., 33.	XVI	87		
4087	R. di.				
4118	P. T., 33.	XVI	89		
4125	C. G. H.	VI	7	Melbourne.	
4160	P. T., 61.	XXVIII	32		
4224	C. G. H.	V	4		

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4229	C. G. H.	V	6		
4230	P. T., 33.	XVI	86		
	P. T., 61.	XXVIII	83		
	H. C.	25			
4234	Lam.	I	1		
	Vogel. ³	14			
4261	C. G. H.	VI	18		
4276				Melbourne.	
4284	C. G. H.	VI	6	Melbourne.	
4290	C. G. H.	VI	3	Melbourne.	
	Lass. ²	VII	30		
4294	H. C.	25			
4302	C. G. H.	VI	4	Melbourne.	
4305	C. G. H.	VI	18		
	C. G. H.	V	1		
4335	C. G. H.	V	5		
4342	C. G. H.	V	2	Trouvelot.	
4343	P. T., 33.	XIII	42		
	Lass. ²	VII	31		
4355	P. T., 33.	XVI	80		
	Lass.				Mem. R. A. S., vol. xxxiii, p. 121.
	Lass. ²	VIII	32		
	C. G. H.	II	2		
	M. A. A.	IV	1		
	H. C.	32			
4361	C. G. H.	I	1	Trouvelot.	
4373	Vogel. ³	14		Trouvelot.	
4375	C. G. H.	VI	16	Melbourne.	
4390	Vogel. ³	14			
	Secchi.	IV	8		
4395	P. T., 33.	X	30		
4403	P. T., 33.	XII	35	Trouvelot.	
	Lass. ²	VII	33		
	Wash'n.	VI	3		
	Holden.				Am. Jour. Sci., 1876, May, p. 341.
	C. G. H.	II	1		
	Lam.	I	10	Melbourne.	
	M. A. A.	VI	1		
	Le Sueur.	I	1		Proc. R. S., 1870.
4419	Struve.	I	2332		Catalogus Novus.
4437	Lam.	I	9		
	Helmert.	I and II			Publications of the Hamburg Observ- atory, vol. i.
4447	P. T., 33.	X	29		Lyra.
	P. T., 44.	XIX	29		
	Vogel. ³	14			
	Wash'n.	VI	2		
	Lass. ³				

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4447	H. C.	34			
	D'Arr.	II	5		
4487	Lam.	I	7		
	Lass. ²	IX	34		
	Vogel. ³	14			
4510	P. T., 33.	XIII	46	-----	Dumb-bell nebula.
	Secchi.	IV	1		
	D'Arr.	II	3		
	Vogel.	I	7		
	Vogel. ³	14			
	Lam.	I	2		
4514	P. T., 33.	XIII	43	Trouvelot.	
	Secchi.	IV	7		
4520				Knobel.	
4532	P. T., 33.	X	26		
	P. T., 44.	XIX	26		
	P. T., 50.	XXXVIII	17		
	P. T., 61.	XXXI	43		
	Lass. ²	IX	35		
	Lass. ³				
	Vogel.	I	6		
	Secchi.	IV	10		
	Smyth.	p. 290		-----	Spec. Hartwell.
	D'Arr.	II	8		
	H. C.	35			
4565	P. T., 33.	XIII	48		
4572	P. T., 33.	XIII	47		
	P. T., 44.	XIX	47		
	P. T., 61.	XXVIII	34		
	Lass. ²	IX	36		
	Lam.	I	5		
	Vogel. ³	14			
4594	P. T., 61.	XXX	36		
4600	P. T., 33.	XI	33		
4616	P. T., 33.	XI	34		
	M. A. A.	VII	1		
4618	P. T., 33.	XVI	82		
	M. A. A.	VII	1		
4627	P. T., 61.	XXX	37		
4628	P. T., 33.	XIII	44		
	P. T., 50.	XXXVIII	14		
	Lass. ²	X	37	-----	Also figured in Proc. R. S., vol. xii, p. 269.
	Vogel. ³	14			
	D'Arr.	II	1		
	Secchi.	IV	2		
	Lam.	I	4		
4670				Knobel.	
4678	P. T., 33.	XVI	88		
	P. T., 44.	XVIII	88	Knobel.	

LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4687	P. T., 33. Secchi.	XVI IV	90 9	Melbourne.	
4729	C. G. H.	IV	11		
4730	C. G. H.	IV	11		
4731	C. G. H.	IV	11		
4733	C. G. H.	IV	11		
4734	P. T., 61.	XXX	88	Trouvelot.	
4764	Vogel.	I	8		
4815	P. T., 61.	XXX	89		
4876	P. T., 33.	XV	73		
4877	P. T., 33.	XV	73		
4886-7	Vogel. ²	I	12		
4892	P. T., 33.	XVI	68		
	P. T., 50.	XXXVI	4		
	D'Arr.	II	6		
4950	P. T., 33.	XIV	60		
4964	P. T., 33.	XIII	45		
	P. T., 50.	XXXVIII	13		
	P. T., 61.	XXX	40		
	Lass. ²	X	38		
	Secchi.	IV	4		
	Lam.	I	8		
4971	P. T., 33.	XVI	85		
	P. T., 61.	XXX	41		
5046	P. T., 61.	XXX	42		

LIST OF FIGURED NEBULÆ—Continued.

Following are given lists of photographs of clusters and double stars which are as yet unpublished. These lists are intended to facilitate comparisons between work done by different observers. The data were furnished by the observers themselves.

LIST OF PHOTOGRAPHS OF STAR GROUPS AND CLUSTERS.

By Dr. L. M. RUTHERFORD.

The "number of stars" is the number of *measurable* stars on the photographic plates, which include a field of about $1^{\circ} 50'$.

Central Star of Group.	Number of measurable stars.
β Cygni -----	36
$\alpha = 20^h 38^m$ -----	40
$\delta = + 35^{\circ} 8'$ -----	
21 Cygni -----	75
B. A. C. 6986 -----	76
27 Cygni -----	70
34 Cygni -----	180
37 Cygni -----	150
58 Cygni -----	40
59 Cygni -----	80
61 Cygni -----	48
$\alpha = 19^h 38^m$ -----	50
$\delta = + 40^{\circ} 0'$ -----	
$\alpha = 19^h 38^m \delta = + 27^{\circ} 7'$ -----	65
$\alpha = 20^h 0^m \delta = + 31^{\circ} 53'$ -----	100
θ Orionis -----	60
Præsepe -----	30
12 Comæ Berenices -----	10
γ Cassiopæ -----	38
μ Cassiopæ -----	48
B. A. C. 8053 -----	24
Perseus -----	90
B. A. C. 723 -----	12
Pleiades -----	56
40 Eridani -----	8
θ Urs. Majoris -----	7
B. A. C. 4010 -----	10
Arcturus -----	11
41 Serpentis -----	7
44 Boëtis -----	4
72 Herculis -----	7
70 Ophiuchi -----	8
20 Vulpeculæ -----	36

LIST OF FIGURED NEBULÆ—Continued.

LIST OF STAR CLUSTERS PHOTOGRAPHED AT THE NATIONAL OBSERVATORY AT CORDOBA, ARGENTINE REPUBLIC. [1875-6.]

[Under the direction of Dr. B. A. GOULD.]

Lac. 1023.	fol. d <i>Velorum</i> .	ζ <i>Lupi</i> .
χ <i>Fornacis</i> .	Lac. 4145.	Lac. 6612.
Pleiades.	n.f. q <i>Carinæ</i> .	Lac. 6697.
Lac. 1339.	Lac. 4270.	Dunlop 326.
θ <i>Orionis</i> .	Lac. 4310.	Dunlop 360.
c <i>Orionis</i> .	Lac. 4375.	22 <i>Scorpii</i> .
P. vi, 233.	t ₂ <i>Carinæ</i> .	Lac. 7017.
o <i>Canis Maj.</i>	θ <i>Carinæ</i> .	ζ <i>Scorpii</i> .
Lac. 2553.	η <i>Carinæ</i> .	Br. 5891.
Lac. 2581.	Lac. 4479.	Lac. 7038.
Lac. 2638.	Br. 8346.	Lac. 7099.
Lac. 2766.	x <i>Carinæ</i> .	Lac. 7345.
Lal. 14868.	y <i>Carinæ</i> .	Lac. 7382 = M. 6.
d <i>Puppis</i> .	Lac. 4809.	Lac. 7478 = M. 7.
c <i>Puppis</i> .	Lac. 4816.	9 <i>Sagittarii</i> .
Lac. 3134.	Lac. 4821.	M. 16.
γ <i>Velorum</i> .	Lac. 5006.	M. 23.
Lac. 3195.	Lac. 5279.	Arg. Uran. <i>Sag.</i> 11.
r <i>Puppis</i> .	κ <i>Crucis</i> .	κ <i>Telescopii</i> .
o <i>Velorum</i> .	Lac. 5659.	Lac. 8357.
Lac. 8466.	Lac. 5818.	<i>Sagittarius</i> 20 ^h 20 ^m ; 48° 50'

UNPUBLISHED DRAWINGS OF NEBULÆ, BY L. TROUVELOT, CAMBRIDGE, MASS.

G. C. 575	G. C. 1823	G. C. 4341 ?
768	2318 ?	4342 ?
801 ?	2343 ?	4358 ?
858	2560	4361
859	2735 ?	4373
1179	2798 ?	4380 ?
1227 ?	3142 ?	4400
1541	4058 ?	4403
1691 ?	4124 ?	4412 ?
1719	4127 ?	4514
1771	4244	4815

NOTE.—Those nebulae marked “?” are not finally identified, as the observing telescope is unprovided with circles. They are, in all cases, very near to the place of the nebula which is drawn.

V.

INDEX TO SIR WILLIAM HERSCHEL'S CATALOGUES
OF NEBULÆ AND CLUSTERS.

[The identifications rest on the authority of Sir JOHN HERSCHEL.]

CLASS I.

[BRIGHT NEBULÆ.]

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
1	591	33	2734	66	1777
2	1771	34	3615	67	2616
3	2038	35	2806	68	3337
4	2041	36	3095	69	3358
5	2396	37	3096	70	3900
6	3702	38	3075	71	4024
7	3146	39	3227	72	2112
8	3228	40	3383	73	2755
9	2776	41	3254	74	2832
10	3176	42	3430	75	2851
11	2758	43	3132	76	2881
12	2942	44	4314	77	2972
13	2301	45	4279	78	1909
14	3166	46	4295	79	2024
15	3198	47	4441	80	2182
16	3273	48	4296	81	2178
17	2203	49	4359	82	2566
18	2207	50	4404	83	3043
19	2752	51	4412	84	3249
20	2405	52	4625	85	3441
21	2499	53	4815	86	2104
22	2925	54 *	214	87	2274
23	3008	55	4892	88	2287
24	3134	56	1861	89	2836
25	3274	57	1863	90	2855
26	2179	58	746	91	3001
27	2229	59	1780	92	3101
28 ¹	2991	60	709	93	3300
28 ²	2994	61	1904	94	2501
29	2347	62	418	95	2804
30	2921	63	589	96	3437
31	3075	64	604	97	3459
32	3110	65	2917	98	3637

*This is not I 54 of the *Phil. Trans.*, but a nebula subsequently inserted by Sir WILLIAM HERSCHEL.

CLASS I — BRIGHT NEBULÆ — Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
99	3843	148	4097	199	2066
100	342	149	4293	200	1713
101	470	150	4331	201	2245
102	574	151	307	202	2604
103	{ 4585	152	487	203	2597
	{ 4586	153	536	204	1684
104	4933	154	549	205	1823
105	431	155	778	206	2708
106	692	156	575	207	2711
107	752	157	396	208	2761
108	263	158	866	209	2811
109	645	159	158	210	2910
110	4998	160	3092	211	3305
111	5000	161	3012	212	3011
112	463	162	3342	213	3002
113	1811	163	2008	214	3783
114	1896	164	2145	215	4058
115	1944	165	2756	216	1781
116	2216	166	2924	217	853
117	2217	167	1778	218	1548
118	{ 2233	168	2052	219	2404
	{ 2236 ?	169	2750	220	2317
119	3103	170	3645	221	2443
120	2554	171	3984	222	2447
121	2663	172	2238	223	2660
122	888	173	2600	224	2707
123	2915	174	2687	225	2717
124	3122	175	2796	226	2379
125	3125	176	3189	227	2476
126	3987	177	3190	228	2564
127	4026	178	3151	229	2637
128	4045	179	3152	230	3749
129	3229	180	3652	231	3782
130	3397	181	3723	232	3794
131	2411	182	3964	233	2248
132	1835	183	3990	234	3048
133	3262	184	3977	235	3856
134	3292	185	3899	236	3897
135	3293	186	3574	237	3934
136	3294	187	3716	238	3715
137	1837	188	3942	239	3720
138	3477	189	3935	240	3726
139	2878	190	3731	241	2371
140	3243	191	3730	242	1711
141	3311	192	4627	243	3315
142	3197	193	386	244	2369
143	3356	194	2413	245	2387
144	3846	195	2723	246	2421
145	3850	196	2745	247	2425
146	3851	197	3041	248	2560
147	4275	198	3042	249	1750

CLASS I.—BRIGHT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
250	1765	203	2738	276	2888
251	2602	204	2835	277	2948
252	2672	265	2051	278	2742
253	2668	266	2073	279	2737
254	3142	267	2245	280	4236
255	3662	268	2257	281	361
256	3671	269	2275	282	1906
257	714	270	2360	283	2081
258	793	271	2362	284	2218
259	2586	272	2170	285	1905
260	1848	273	3127	286	1982
261	1137	274	3181	287	2452
262	2420	275	2868	288	1691

CLASS II.

[FAINT NEBULÆ.]

1	4739	31	3130	60	2734
2	4900	32	2388	61	2871
3	78	33	2386	62	2875
4	351	34	2071	63	2885
5	581	35	3009	64	2929
6	573	36	3045	65	2987
7	860	37	3076	66	3052
8	858	38	3169	67	3077
9	859	39	3196	68	3105
10	5039	40	1869	69	3144
11	2824	41	2211	70	3171
12	3184	42	2315	71	3193
13	2434	43	2034	72	3225
14	2730	44	2058	73	3256
15	3118	45	2061	74	3274
16	2258	46	{ 2149	75	3278
17	2821		{ 2150 ?	76	4122
18	3020	47	2243	77	2175
19	3147	48	1707	78	2193
20	3174	49	2352	79	3927
21	3302	50	2358	80	1704
22	3506	51	2359	81	2195
23	2978	52	2376	82	2254
24	3285	53	2399	83	2757
25	3539	54	2427	84	2894
26	3004	55	2957	85	2891
27	3923	56	3003	86	2903
28	2088	57	1839	87	{ 2943 ?
29	2089	58	1840		{ 2951
30	2382	59	1975	88	2966

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
89	2981	140	2847	191	3377
90	3003	141	2893	192	4055
91	3038	142	2899	193	3486
92	3053	143	2904	194	3838
93	3067	144	2926	195	4269
94	3084	145	2982	196	3954
95	3240	146	2986	197	4374
96	4116	147	3082	198	4371
97	4139	148	3148	199	4357
98	1956	149	3157	200	4364
99	2201	150	3910	201	4389
100	2273	151	4178	202	4527
101	2276	152	2428	203	4632
102	2350	153	2507	204	4407
103	2488	154	2510	205	4414
104	2541	155	2979	206	4607
105	2708	156	2999	207	4760
106	2783	157	3019	208	5003 ?
107	2799	158	3068		5004
108	2802	159	2419	209	111
109	2814	160	2423	210	176
110	2845	161	2490	211	560
111	2874	162	2621	212	4883
112	2877	163	2787	213	5011
113	2977	164	2794	214	167
114	3030	165	2795	215	202
115	3025	166	2848	216	203
116	3029	167	2955	217	206
117	3026	168	2956	218	212
118	3050	169	2974	219	221
119	3084	170	2983	220	222
120	3093	171	2984	221	442
121	3010	172	2988	222	455
122	3013	173	2993	223	469
123	3028	174	3013	224	218
124	3031	175	3081	225	526
125	3173	176	3171	226	4971
126	3187	177	3569	227	5049
127	3192	178	4111	228	399
128	3219	179	4112	229	402
129	3450	180	3005	230	5020
130	4105	181	3214	231	5022
131	2231	182	3221	232	5038
132	2626	183	3131	233	4821
133	2777	184	3140	234	4824
134	2791	185	3121	235	4910
135	2805	186	3287	236	4928
136	2813	187	3297	237	554 ?
137	2812	188	3390	238	571
138	2943	189	3418	239	684 ?
139	2842	190	3373	240	5046

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
241	29	292	1043	343	3099
242	4973	293	1992	344	3266
243	29	294	2611	345	3298
244	4991	295	2658	346	3324
245	125	296	2661	347	2107
246	516	297	3614	348	2168
247	4734	298	3251	349	2433
248	4790	299	3338	350	2437
249	4880	300	3355	351	2446
250	4939	301	3420	352	2473
251	4879	302	1596	353	2765
252	298	303	1640	354	2803
253	390	304	1477	355	3006
254	620	305	2011	356	3446
255	5005	306	3660	357	3903
256	5006	307	3673	358	2131
257	47	308	3685	359	2134
258	651	309	3750	360	2204
259	1653	310	3751	361	2220
260	1872	311	1013	362	2227
261	4705	312	3482	363	2230
262	734	313	3491	364	2251
263	743	314	3527	365	2293
264	1335	315	1660	366	2295
265	1384	316	1519	367	2439
266	1674	317	1520	368	2649
267	759	318	1670	369	2655
268	1981	319	1676	370	2719
269	2341	320	2001	371	2743
270	430	321	2744	372	2771
271	448	322	2855	373	2781
272	449	323	2858	374	2790
273	601	324	2887	375	2800
274	626	325	3074	376	2854
275	1898	326	3207	377	2859
276	2675	327	3495	378	2882
277	2696	328	3524	379	2931
278	551	329	3891	380	3100
279	805	330	3914	381	3222
280	1721	331	3875	382	3303
281	1730	332	4034	383	3314
282	363	333	1969	384	3319
283	377	334	1971	385	3336
284	582	335	2221	386	3333
285	647	336	2298	387	3331
286	654	337	2325	388	3344
287	688	338	2350	389	3347
288	738	339	2426	390	3353
289	1096	340	2487	381	3351
290	726	341	2511	392	3364
291	762	342	2575	393	3368

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
304	3369	445	130	496	2823
395	3385	446	154	497	2989
396	3391	447	239	498	3020
397	3396	448	322	499	3040
398	3400	449	323	500	3080
399	4113	450	4876	501	406
400	4090	451	4877	502	636
401	4106	452	107	503	643
402	4180	453	4851	504	648
403	2603	454	4925	505	1796
404	2664	455	758	506	1865
405	2762	456	760	507	2291
406	2901	457	908	508	2665
407	3104	458	773	509	2679
408	2563	459	777	510	3461
409	2784	460	781	511	3465
410	3083	461	304	512	3469
411	3154	462	315	513	3473
412	3242	463	326	514	877
413	3395	464	836	515	886
414	3444	465	606	516	943
415	3692	466	605	517	3361
416	3754	467	4921	518	2817
417	3756	468	5029	519	2819
418	3826	469	4792	520	1763
419	3833	470	624	521	2361
420	3890	471	69	522	887
421	3917	472	141	523	895
422	3933	473	353	524	876
423	3948	474	515	525	890
424	3687	475	644	526	900
425	4135	476	4807	527	920
426	4601	477	4833	528	924
427	4605	478	74	529	1739
428	4808	479	95	530	2941
429	4906	480	114	531	3032
430	4909	481	404	532	3164
431	4932	482	495	533	3655
432	4997	483	497	534	3704
433	185	484	498	535	3283
434	190	485	499	536	3330
435	474	486	504	537	3432
436	518	487	547	538	3985
437	520	488	586	539	4021
438	529	489	543	540	4033
439	4936	490	1768	541	4039
440	4940	491	1899	542	4038
441	4946	492	1973	543	4047
442	4831	493	2232	544	4050
443	4849	494	2235	545	4061
444	122	495	1864	546	1845

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
547	1847	597	772	648	3951
548	2739	598	4834	649	3959
549	3318	599	4746	650	4077
550	2383	600	4950	651	4104
551	2384	601	613	652	4204
552	2449	602	616	653	3526
553	2557	603	674	654	4110
554	1612	604	488	655	4126
555	1854	605	494	656	4129
556	1882	606	4768	657	4147
557	1736	607	637	658	1718
558	3191	608	641	659	3159
559	3288	609	136	660	3160
560	3299	610	391	661	3188
561	3381	611	395	662	3233
562	2441	612	403	663	3402
563	3320	613	506	664	3452
564	1774	614	1449	665	3505
565	2205	615	1448	666	3520
566	3487	616	1562	667	3537
567	3503	617	410	668	3644
568	2852 ?	618	414	669	3669
569	2857 ?	619	627	670	3682
570	2862 ?	620	635	671	3701
571	2856 ?	621	145	672	3743
	2865 ?	622	238	673	3876
572	2876	623	2609	674	3896
573	2857	624	1914	675	3952
574	3926	625	2911	676	4008
575	3956	626	2355	677	4010
576	3999	627	1634	678	4071
577	3138	628	2886	679	3565
578	3231	629	3026	680	3566
579	3845	630	3017	681	3947
580	3902	631	3056	682	3971
581	3904	632	3133	683	4013
582	3946	633	592	684	4057
583	4145	634	1646	685	3675
584	4246	635	2401	686	3686
585	4056	636	3135	687	3806
586	4333	637	3445	688	3656
587	4325	638	3620	689	3576
588	394	639	2030	690	4202
589	397	640	2035	691	3761
590	4884	641	2173	692	3789
591	7	642	2760	693	3790
592	576	643	3195	694	3870
593	747	644	3341	695	3920
594	774	645	3365	696	3931
595	4738	646	3511	697	3689
596	426	647	4205	698	3718

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
699	3740	750	3011	799	3758
700	3953	751	4051	800	3784
701	4231	752	4052	801	3795
702	4850	753	4218	802	2754
703	145	754	3854	803	2764
704	638	755	4062	804	2853
705	4827	756	4025	805	2866
706	4907		4029 ?	806	2897
707	90	757	4064	807	3025
708	1788	758	4082	808	3940
709	2353	759	4087	809	3991
710	3663	760	4085	810	4185
711	3665	761	4114	811	4192
712	3674	762	4115	812	4291
713	3688	763	4074	813	2782
714	3693	764	4128	814	3255
715	3694	765	4130	815	3424
716	3710	766	4131	816	3462
717	1924	767	4292	817	3617
718	2225	768	847	818	4065
719	1633	769	1496	819	2330
720	2069	770	2424	820	1529
721	2072	771	3054	821	1546
722	2074	772	3161	822	1554
723	2556	773	3162	823	1720
724	2624	774	3202	824	2583
725	2657	775	2394	825	2587
726	1626	776	3036	826	3512
727	1689	777	3316	827	3752
728	2339	778	3350	828	1759
729	2363	779	3371	829	2408
730	2445	780	3492	830	2494
731	2471	781	2692	831	2520
732	2477	782	2397	832	2561
733	2652	783	2454	833	2612
734	1486	784	2461	834	1742
735	1489	785	2555	835	1957
736	1497	786	2576	836	2444
737	2498	787	2578	837	2465
738	2559	788	2584	838	2472
739	2562	789	2618	839	2485
740	2590	790	2619	840	2627
741	2676	791	2634	841	3590
742	2834	792	2770	842	3592
743	2945	793	2792	843	3709
744	3150	794 ¹	3177	844	3714
745	2166	794 ²	3179	845	2407
746	3448	795	3216	846	2839
747	2749	796	3224	847	2895
748	2807	797	3578	848	2998
749	2950	798	3639	849	3069

CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
850	3089	870	2117	890	3799
851	5024	871	2125	891	3913
852	764	872	2215	892	3921
853	14	873	4158	893	3932
854	62	874	4102	894	3937
855	66	875	4208	895	3924
856	98	876	3800	896	3625
857	97	877	3809	897	4761
858	104	878	4513	898	2004
859	412	879	2372	899	3672
860	101	880	2395	900	660
861	1482	881	2547	901	4308
862	1491	882	2087	902	4383
863	143	883	2098	903	1970
864	2570	884	2299	904	2302
865	2720	885	2375	905	2460
866	2721	886	2415	906	4109
867	2788	887	2242	907	4417
868	1797	888	2265	908	1690
869	1798	889	3712	909	1972

CLASS III.

[VERY FAINT NEBULÆ.]

1	1185 ??	23	2303	45	3560
2	511	24	1990	46	3561
3	2662	25	2047	47	3825
4	1884	26	3078	48	3988
5	2177	27	2356	49	1688
6	3228	28	2423	50	1696
7	1618	29	2469	51	1942
8	1857	30	2493	52	1945
9	3582	31	2908	53	2026
10	3583	32	3798	54	2147
11	3746	33	4157	55	2148
12	3849	34	1912	56	3744
13	3117	35	2531	57	3759
14	3889	36	2534	58	3780
15	2389	37	2691	59	3791
16	2391	38	2923	60	1752
17	2970	39	2967	61	1773
18	3055	40	3033	62	1786
19	1540	41	3039	63	1787
20	2240	42	3046	64	1825
21	2277	43	3143	65	2014
22	2289	44	3180	66	2153

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
67	2267	118	3488	169	297
68	2736	119	3510	170	319
69	3051	120	3873	171	325
70	3277	121	3864	172	328
71	3562	122	3866	173	329
72	3616	123	4262	174	362
73	4152	124	4266	175	401
74	4167	125	3732	176	443
75	2282	126	3908	177	542
76	2366	127	3955	178	631
77	2669	128	3958	179	416
78	3065	129	4000	180	4809
79	2323	130	4002	181	4915
80	2448	131	4016	182	4926
81	2474	132	3901	183	25
82	3272	133	3982	184	4899
83	3348	134	3818	185	4923
84	3529	135	3863	186	4930
85	3596	136	3877	187	4931
86	3595	137	4303	188	4984
87	3597	138	4070	189	4999
88	2234	139	4081	190	5057
89	2328	140	4161	191	189
90	2580	141	4573	192	419
91	2833	142	4582	193	453
92	2872	143	4444	194	667
93	2873	144	4536	195	684
94	2907	145	4653	196	701
95	2905	146	4996	197	700
96	2906	147	9	198	571
97	2922	148	53	199	628
98	3126	149	124	200	109
99	3584	150	355	201	513
100	3605	151	484	202	4890
101	3608	152	572	203	4898
102	2517	153	149	204	135
103	2544	154	230	205	258
104	2542	155	229	206	267
105	3136	156	272	207	478
106	3291	157	278	208	483
107	2187	158	289	209	4646
108	2237	159	294	210	4886
109	2481	160	295	211	4887
110	3857	161	568	212	4961
111	2310	162	594	213	4980
112	2417	163	598	214	466
113	2577	164	653	215	471
114	2980	165	4741	216	4845
115	3538	166	4823	217	4846
116	4067	167	299	218	4953
117	3485	168	301	219	4598

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
220	4903	270	1287	321	2568
221	4920	271	1452	322	2601
222	4922	272	1962	323	2641
223	86	273	1976	324	2646
223	83 ??	274	2628	325	2649
224	535	275	1761	326	2716
225	1321	276	1860	327	2753
226	4966	277	1918	328	3201
227	493	278	1919	329	3204
228	585	279	2667	330	2080
229	587	280	3250	331	2129
230	4888	281	3276	332	2268
231	5025	282	3483	333	2364
232	5026	283	3936	334	2368
233	5028	284	2504	335	2392
234	1662	285	3708	336	2393
235	1680	286	3777	337	2409
236	1762	287	3786	338	2497
237	4811	288	1648	339	2502
238	4924	289	1911	340	2516
239	540	290	2610	341	2574
240	1182	291	1756	342	2605
241	1271	292	1665	343	2629
242	1799	293	1974	344	2643
243	4871	294	1709	345	2644
244	113	295	1779	346	3416
245	640	296	1785	347	3844
246	724	297	1856	348	2064
247	749	298	1873	349	2123
248	765	299	2850	350	2304
249	771	300	2861	351	2319
250	263	301	3044	352	2320
251	269	302	3063	353	2440
252	276	303	3401	354	2645 ?
253	303	304	3405	355	2704
254	1958	305	3436	356	2740
255	2028	306	3475	357	2741
256	1641	307	3476	358	2769
257	1675	308	3481	359	2772
258	2700	309	3484	360	2773
259	503	310	3930	361	2954
260	509	311	4022	362	3027
261	546	312	4037	363	3354
262	652	313	4146	364	3372
263	753	314	4174	365	3419
264	1740	315	1895	366	3433
265	441	316	2111	367	3458
266	440	317	2176	368	3514
267	1274	318	2190	369	3618
268	998	319	3888	370	3628
269	1196	320	2500	371	4143

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
372	2551	423	3668	474	541
373	3998	424	3246	475	583
374	4092	425	3603	476	79
375	2495	426	4975	477	160
376	2506	427	5010	478	1996
377	2527	428	30	479	1578
378	2533	429	156	480	2829
379	2589	430	155	481	2913
380	2599	431	344	482	2973
381	2608	432	354	483	3018
382	2710	433	475	484	3037
383	2713	434	570	485	129
384	2714	435	4938	486	523
385	2537	436	5047	487	725
386	2535	437	5013	488	1829
387	2543	438	4965	489	3279
388	2552	439	159	490	837
389	2596	440	254	491	2674
390	2678	441	332	492	2976
391	2694	442	333	493	3090
392	2693	443	661	494	3175
393	2697	444	690	495	3123
394	2699	445	704	496	3259
395	2701	446	727	497	2241
396	2702	447	1130	498	2279
397	2797	448	1308	499	812
398	3215	449	611	500	997
399	2766	450	615	501	911
400	2712	451	745	502	915
401	3423	452	4718	503	955
402	3533	453	981	504	3129
403	3534	454	366	505	3619
404	3540	455	602	506	3696
405	3545	456	19	507	3579
406	3577	457	510	508	3978
407	3598	458	4780	509	3137
408	3601	459	408	510	1308
409	3610	460	435	511	4042
410	3630	461	10	512	1617
411	3735	462	608	513	1870
412	3737	463	151	514	3232
413	3757	464	459	515	3260
414	3822	465	4870	516	3284
415	3852	466	5036	517	3269
416	3859	467	78	518	2023
417	3860	468	465	519	1867
418	3865	469	630	520	1838
419	3884	470	4904	521	1907
420	3938	471	368	522	2228
421	3664	472	562	523	3212
422	3915	473	4952	524	3230

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
525	3282	576	4868	627	1820
526	3295	577	268	628	1826
527	1900	578	646	629	1831
528	1908	579	4080	630	1832
529	2346	580	623	631	2097
530	2402	581	579	632	2263
531	2406	582	607	633	3498
532	2429	583	472	634	4119
533	2726	584	590	635	4136
534	2774	585	872	636	4137
535	2846	586	873	637	4160
536	3244	587	851	638	4195
537	3267	588	893	639	4198
538	3301	589	903	640	4212
539	3499	590	1160	641	4214
540	1737	591	656	642	3567
541	1891	592	234	643	3581
542	1978	593	237	644	3814
543	3218	594	281	645	3911
544	3280	595	100	646	4151
545	3449	596	1985	647	1760
546	3721	597	1875	648	2916
547	3725	598	2292	649	3454
548	3304	599	1661	650	3501
549	3677	600	1963	651	3548
550	3970	601	1968	652	3568
551	3836	602	3113	653	3753
552	3839	603	3167	654	3422
553	4164	604	501	655	3435
554	4004	605	1614	656	3587
555	4377	606	1642	657	3979
556	313	607	1645	658	3980
557	569	608	1751	659	4069
558	4896	609	2482	660	4078
559	733	610	3238	661	4098
560	327	611	3248	662	3186
561	409	612	2607	663	3200
562	422	613	3332	664	3220
563	427	614	3352	665	3680
564	420	615	2154	666	3728
565	421	616	2591	667	3736
566	481	617	2659	668	3872
567	496	618	3286	669	3447
568	691	619	3507	670	3468
569	756	620	3612	671	3968
570	533	621	3659	672	3559
571	537	622	4156	673	3623
572	565	623	4182	674	3804
573	566	624	4188	675	3965
574	686	625	1729	676	3812
575	687	626	1758	677	3890

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
678	4015	729	2953	780	3414
679	4019	730	4222	781	3410
680	4201	731	3827	782	3411
681	3658	732	3831	783	3406
682	3700	733	3867	784	3553
683	3739	734	3871	785	3649
684	3741	735	4248	786	3707
685	3810	736	4063	787	{ 3766
686	3981	737	4080		{ 3760 ?
687	3992	738	4134	788	{ 3778
688	4177	739	4149		{ 3773 ?
689	4257	740	4190	789	{ 3774 ?
690	3994	741	4323		{ 3779
691	4012	742	4462	790	3787
692	4728	743	4487	791	3793
693	4737	744	4507	792	2219
694	718	745	4866	793	2263
695	531	746	1501	794	2682
696	4706	747	1167	795	2746
697	2779	748	1515	796	2789
698	3693	749	1795	797	2793
699	3695	750	1604	798	2860
700	2165	751	1897	799	2914
701	2199	752	1625	800	2918
702	2837	753	1657	801	2920
703	1528	754	2706	802	3091
704	2060	755	2963	803	3622
705	2269	756	2964	804	3820
706	2349	757	3070	805	3829
707	2631	758	3345	806	4006
708	2729	759	3346	807	3094
709	1607	760	3374	808	3509
710	1631	761	3384	809	3711
711	1639	762	3788	810	3733
712	1714	763	3886	811	4028
713	1836	764	3014	812	4171
714	1833	765	3408	813	4219
715	2571	766	3423	814	2747
716	2585	767	2146	815	3235
717	2715	768	2398	816	3306
718	2808	769	2592	817	3326
719	2827	770	2348	818	3376
720	2828	771	2450	819	3431
721	3261	772	2453	820	3440
722	3236	773	2483	821	3552
723	2334	774	2509	822	3599
724	3494	775	2513	823	3609
725	2830	776	2532	824	2281
726	2864	777	2778	825	1754
727	4247	778	3206	826	1776
728	4267	779	3403	827	1822

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
828	2553	878	1790	928	3600
829	1558	879	2047	929	3678
830	1591	880	3107	930	4723
831	1719	881	2213	931	4707
832	1789	882	3929	932	4775
833	2539	883	4165	933	4779
834	3061	884	4168	934	1984
835	3820	885	3995	935	2451
836	1590	886	4048	936	4669
837	1600	887	4049	937	3409
838	1606	888	4176	938	2919
839	1610	889	4172	939	3112
840	1628	890	4115	940	2558
841	1731	891	4186	941	2763
842	2185	892	4191	942	2898
843	2463	893	4226	943	4089
844	2484	894	3957	944	4091
845	2759	895	3961	945	4282
846	1844	896	3983	946	3650
847	2455	897	1458	947	3765
848	3438	898	1457	948	3837
849	3684	899	1493	949	3907
850	2801	900	1539	950	3963
851	2826	901	1531	951	4286
852	2952	902	1654	952	884
853	1977	903	2066	953	885
854	5015	904	2731	954	81
855	5042	905	2615	955	153
856	5043	906	3223	956	676
857	732	907	3268	957	4348
858	4659	908	3339	958	4349
859	4672	909	3460	959	708
860	4972	910	2056	960	730
861	18	911	2082	961	740
862	4764	912	2138	962	787
863	4776	913	2224	963	1883
864	4778	914	2244	964	2045
865	1188	915	2307	965	2062
866	5	916	1998	966	2065
867	5037	917	2140	967	2284
868	4	918	2142	968	2285
869	59	919	2223	969	2458
870	89	920	2314	970	2567
871	84	921	2344	971	2598
872	96	922	2410	972	2266
873	102	923	3676	973	4163
874	1481	924	3861	974	4253
875	1489	925	3516	975	4425
876	88	926	3588	976	4011
877	1623	927	3868	977	1866

CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
978	1966	981	2079	983	1682
979	2077	982	1679	984	5044
980	2078				

CLASS IV.

[PLANETARY NEBULÆ: STARS WITH BURS, WITH MILKY
CHEVELURE, WITH SHORT RAYS, REMARKABLE
SHAPES, Etc.]

1	4628	28 ¹	2670	54	2748
2	1437	28 ²	2671	55	1629
3	1425	29	2255	56	2680
4	2403	30	3340	57	4274
5	3066	31	4802	58	20
6	2231	32	932	59	2400
7	2290	33	1202	60	2158
8	3108	34	1225	61	2635
9	3109	35	1672	62	2620
10	2099	36	1270	63	3575
11	4302	37	4373	64	1567
12	4378	38	1373	65	1500
13	4565	39	1565	66	1728
14	4479	40	3307	67	2613
15	12	41	4355	68	1888
16	4572	42	400	69	810
17	664	43	639	70	3536
18	4964	44	1359	71	4053
19	1362	45	1532	72	4561
20	1375	46	3801	73	4514
21	1170	47	3366	74	4634
22	1589	48	1999	75	4702
23	544	49	3808	76	4594
24	1226	50	4244	77	705
25	1487	51	4510	78	3270
26	826	52	4947	79	1950
27	2102	53	801		

CLASS V.

[VERY LARGE NEBULÆ.]

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
1	138	19	527	36	106
2	3085	20	132	37	4621 ?
3	3363	21	1511	38	1116
4	2733	22	3557	39	2294
5	2867	23	1947	40	2296
6	3648	24	3106	41	2831
7	2180	25	131	42	3165
8	2378	26	1931	43	2841
9	4363	27	1440	44	1541
10	4355	28	1227	45	2606
11	4355	29 ¹	2958	46	2318
12	4355	29 ²	2962	47	1983
13	4368	30	1180	48	610
14	4616	31	1183	49	879
15	4600	32	1005	50	1923
16	31	33	1115	51	2825
17	352	34	1193	52	2189
18	105	35	—		

CLASS VI.

[VERY COMPRESSED AND RICH CLUSTERS OF STARS.]

1	1549	15	4433	29	4774
2	1467	16	4521 ?	30	5031
3	1444	17	1351	31	392
4	1964	18	1471	32	4676
5	1383	19	4075	33	512
6	1508 ?	20	162	34	521
7	3472	21	1442	35	68
8	3967	22	1637	36	1559
9	3776	23	4416	37	1611
10	4193	24	4648	38	4499
11	4268	25	658	39	1651
12	4270	26	871	40	4211
13	4335	27	1465	41	4321
14	4998	28	1435	42	4590

CLASS VII.

[PRETTY MUCH COMPRESSED CLUSTERS OF LARGE OR
SMALL STARS.]

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
1	905	24	1310	46	387
2	1424	25	1376	47	802
3	799	26	1409	48	330
4	1030	27	1503	49	378
5	1419	28	1552	50	4664
6	1509	29	4140	51	4661
7	4378	30	4388	52	4673
8	4591	31	4392	53	4755
9	4516	32	457	54	1431
10	1598	33	1067	55	5016
11	1630	34	1092	56	5032
12	1512	35	1408	57	1381
13	1391	36	1445	58	1595
14	1479	37	1438	59	4544
15	1505	38	1484	60	809
16	1507	39	1114	61	820
17	1513	40	4701	62	4471
18	4512	41	4707	63	1678
19	4470	42	256	64	1649
20	1399	43	4864	65	1539
31	977	44	4902	66	4709
22	1432	45	244	67	1550
23	1601				

CLASS VIII.

[COARSELY SCATTERED CLUSTERS OF STARS.]

1 ¹	1613	13	4453	26	1325
1 ²	1480	14	4418	27	1516
2	1264	15	4398	28	1229
3	1429	16	4518	29	5055
4	1104	17	4589	30	1624
5	1440	18	4519	31	1453
6	1371	19	4522	32	1494
7	906	20	4559	33	1498
8	896	21	4497	34	1506
9	1417	22	4557	35	1521
10	1798	23	4597	36	1535
11	1534	24	1361	37	1545
12	4426	25	1415	38	1551

CLASS VIII.—COARSELY SCATTERED CLUSTERS OF STARS—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
39	1466	56	4575	73	4515
40	1490	57	4638	74	4640
41	1015	58	4620	75	4773
42	1199	59	907	76	4615
43	970	60	1473	77	4842
44	1533	61	996	78	120
45	1510	62	4990	79	63
46	1557	63	4771	80	775
47	1556	64	204	81	4493
48	1436	65	389	82	4613
49	1421	66	578	83	4566
50	1430	67	4719	84	720
51	1469	68	1323	85	831
52	1544	69	4976	86	4551
53	4353	70	855	87	1553
54	4385	71	1451	88	717
55	4396	72	4410		

VI.

INDEX TO MESSIER'S CATALOGUE OF NEBULÆ, Etc.

Messier's No.	Gen. Cat. No.	Messier's No.	Gen. Cat. No.	Messier's No	Gen. Cat. No.
1	1157	36	1168	71	4520
2	4678	37	1295	72	4608
3	3636	38	1119	73	4617
4	4183	39	4681	74	372
5	4083	40	—	75	4543
6	4318	41	1454	76	385
7	4340	42	1179	77	600
8	4361	43	1185	78	1267
9	4287	44	1681 *	79	1112
10	4256	45	The <i>Pleiades</i> .	80	4173
11	4437	46	1564	81	{ 1949
12	4238	47	1594		{ 1953
13	4230	48	—	82	1950
14	4315	49	3021	83	3606
15	4670	50	1483	84	2930
16	4400	51	3572	85	2946
17	4403	52	4957	86	2961
18	4401	53	3453	87	3035
19	4264	54	4442	88	3049
20	4355	55	4503	89	3097
21	4367	56	4485	90	3111
22	4424	57	4447	91	3120 ?
23	4346	58	3121	92	4294
24	4397	59	3155	93	1571
25	—	60	3182	94	3258
26	4432	61	2878	95	2184
27	4532	62	4261	96	2194
28	4406	63	3474	97	2343
29	4576	64	3321	98	2786
30	4687	65	2373	99	2838
31	116	66	2377	100	2890
32	117	67	1712	101	8770
33	352	68	3128	102	—
34	584	69	4411	103	341
35	1360	70	4428		

[* *Præsepe*]

NOTE.

Since the preceding pages were in type I have received, through the kindness of Mr. E. B. KNOBEL, the following additions, etc., which mostly refer to works not accessible to me.

<i>Page.</i>	<i>Author.</i>	<i>Correction.</i>
7	BAILY -----	Chart of the <i>Pleiades</i> in "Astronomical Tables and Remarks for the year 1822." London, 1822.
8	BODE-----	Description et Connoissance générale des Constellations. Berlin, 1801. [Contains catalogue of 1,802 nebulae and 212 clusters.]
8	BODE-----	Catalogue * * * de 5505 Etoiles. Berlin, 1805. [Contains catalogue of 372 nebulae and clusters.]
11	CATUREGLI ----	Catalogue of stars in the <i>Pleiades</i> . <i>Bologna Ephem. Mot. Coelest</i> , 1823-1828. Appendix.
44	LE MONNIER --	Recueil de Tables Astronomiques, vol. i, pp. 203 and 205. [Catalogues of stars in the <i>Hyades</i> and <i>Pleiades</i> .]
49	PIAZZI -----	Catalogue of stars in the <i>Pleiades</i> . <i>B. J.</i> , 1817, p. 223. Chart.
55	SECCHI -----	<i>Mem. Coll. Romano</i> , 1863-'66. [Contains observations of several nebulae and clusters, with drawings.]
60	ULUGH-BEIGH -	HYDE's Commentary, p. 20. [Cluster in <i>Perseus</i> .]

